April 8, 1920 American Machinist Vol. 52, No. 15

MODERN PRODUCTION METHODS

By
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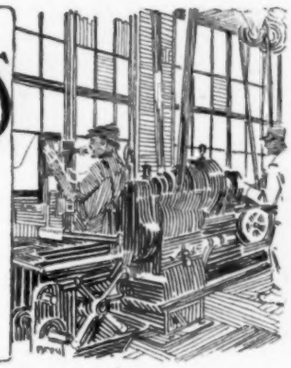


IF YOUR product happens to be one in which several parts are assembled, it's a safe guess you have at times had production held up because one vital part had not reached the assembly department on time. It is no help that the other hundred-odd parts are there waiting—if a small and seemingly trivial part is late at the assembly floor, it may keep you from shipping the entire machine.

You know what that means—customers disappointed in deliveries, an assembly room clogged with waiting material, idle assemblers and a lot of money tied up in materials that should be shipped.

Sometimes, of course, this condition cannot be helped, for accidents will happen to machines and men will quit unexpectedly. But most trouble of this sort comes not from either of these causes, but from failure to schedule operations so that enough of all parts will arrive at the assembly department each day to get out that day's quota of assembled product.

Unless every step of production is planned, it is not surprising that shipments of finished product are irregular and impossible to prophesy accurately.

Where production is not planned, the method of getting work through the shop may be described as "muscling' it through. The "muscling" is done either by foremen or tracers.

Under this plan of running the shop, the foreman is given a copy of the sales order or perhaps a bill of material, and from his knowledge of the article, will pick out such parts that his department usually makes, and make them. He is in no position to judge when to start it to best advantage for he has no knowledge as to how long it will take to make the other parts that go into the assembly.

If the material he needs is on hand, he grabs it and starts as soon as he has a man and machine idle. If he can't find material, he requisitions what he thinks he needs from the purchasing agent and with a copy of the requisition in his possession to "clear his skirts," waits without further effort for the purchasing agent to get the material to him. A few energetic foremen go at production rough-and-tumble. They remind me of the "typical" American army officer of whom I recently read, whose presumably effective tactics enabled him to put through tremendous engineering projects in an unheard of short time.

This officer's success in driving his work through to a finish ahead of schedule seemed generally to be due to his knack of beating the other fellows to it in the matter of obtaining labor and materials.

Perhaps he would divert a string of empty cars to his own use which should have gone elsewhere, or again he would use material that some other branch of the work needed urgently and depended upon. The reader of this story of achievement wonders about the success of the others who were left without their transportation facilities and supplies.

Such violent methods, usually referred to admiringly as "getting things done" are not always praiseworthy. An army or a factory achieves the desired results only when it acts with all parts subservient to the whole. It does no good for one department to show phenomenal results—a "clean slate"—if it does so at the expense of other departments.

What counts in manufacturing is not a rapid production of a single part of a product, but the amount of completely finished goods shipped out at the back door. It is this that production planning aims to accomplish in a shop.

Many machine-shop executives have said to me, "Production planning is fine for those who can use it, but my business is different. It can't be planned."

Admittedly, the work of all shops cannot be rigidly planned weeks in advance. Some emergencies come up in every plant. The usual objection is that accidents to machinery, failure to get raw materials and other circumstances beyond your control may render all this work abortive. Of course, no one is a prophet, but a wise man plans ahead on the information that is available and then changes his plans according to circum-

I. What Production Planning Does

Most manufacturers have had their sad experiences with "efficiency engineers" whose principal stock in trade was salesmanship and a vast overestimate of their own ability. They have given the real "business doctors" an undeserved black eye. The first article of a comprehensive series by the president of a well-known firm of engineering accountants gives a bird's-eye view of the field to be covered in detail in subsequent installments, and points out the importance of careful advance planning of production.

stances. But I have noticed that at least 80 per cent of the things we plan for, work out. That leaves us only 20 per cent to handle on the emergency basis, whereas if we do not plan, the whole 100 per cent becomes an emergency proposition.

I truly believe that 80 per cent of the emergency production in any shop can, by planning, be reduced to routine. But the method of planning and the degree to which production should be planned depends upon the type of work done by the shop.

Machine shops fall into one of three classes depending upon the sales policy which governs production.

First, there are the job shops which will make almost anything that the sales force can sell. The order may be for a machine unlike any turned out before and it may be for a dozen or more of a kind.

Second, there is the shop that manufactures many types of product of a class, but always in quantity. It may make several thousand gears, transmissions, differentials, and so on to the customer's special design. Or it may make several standard styles of adding machines of its own unvarying design, to stock.

The third class of shop is the one which makes but a single style of one product. There are few such, the Ford Motor Co. being one of the few.

Perhaps he would divert a string of empty cars

The planning for this latest type is largely preliminary. It consists of getting the best possible layout of machines and of departments and supplying the proper tools and machines in sufficient quantity to give a certain production per day. The single product then flows in a perpetual stream, day in and day out.

A machine tool once started on an operation can remain on it indefinitely, barring a breakdown. Production planning as we think of it is not needed in such a plant, and the shop executives can give all of their time to keeping the wheels going round without hitches.

In the jobbing shop, it is admittedly hard at first to plan accurately, and yet it is in the job shop that planning is most needed for there the work is most irregular and losses from idle machine time are most apt to climb. In such shops, especially, it is customary to look upon every new order as an emergency. Unfortunately, the idea seems to be about that the owner of a job shop must throw up his hands in despair of bettering conditions. This is probably because the economies to be had from planning were first seen by the owners of the larger shops in the automotive industry where quantity production of a comparatively few types of product was the rule.

But work in the job shop *can* be planned. It has even been accomplished in the repair shops of industries where a repair is an emergency job indeed, as interrupted production of a large machine may cost thousands of dollars in a few hours. In one repair shop for which we planned production the repairs are now made in about one-half the time they formerly took. This not only reduces the direct cost of repairs but means an economy through increasing the running hours of equipment in the productive departments.

I do not propose in these articles to describe in detail the planning work in the strictly job shop, for the very sufficient reason that no two such shops are at all alike, either in the work handled or the equipment available; but I can give in outline the steps in planning the work.

As a basis for planning in a job shop it is necessary to know just what machines there are in the shop and what operations each can perform. Then we must gather data which will serve as a basis on which we can estimate the time needed to perform any conceivable operation. This, to many a shop man, seems impossible. It is the reason always put forward to prove that the work cannot be planned. If the shop has been in operation for a year or so, there should be a mass of information on hand to show, for jobs already done, what the job was, what machine each operation was done on and how long each operation took. A study of these operations will show that they can be grouped into a surprisingly few classifications and so tabulated that they will afford a basis for a quick and sufficiently close estimate of the time needed for any new job that comes in.

This list of jobs and operations should show the tooling, fixtures available, speeds and feeds. Then for practically every job we will not only be able to estimate the time needed for each operation, but we can give the workman full instructions for the work so that he can spend his time in doing the jobs, rather than fiddling around "getting ready to start to begin."

One thing more is needed—a means for showing the executive what work is ahead of each machine, how long the machines will be busy on work already in the shop, when each operation should be finished in order to meet the customer's requirements, what machines are now idle and when the others will run out of work.

This information allows the shop to give accurate promises of delivery based upon knowledge of the shop's capacity, rather than on optimistic guesses warped by the salesman's desire to land an order.

This information can all be given graphically on the "schedule control graph" which I shall describe in detail in a later article. Of course changes in that graph will have to be made to meet the needs of the individual shop, but the changes needed will be apparent, I think, to the reader.

The real complications in planning come in the shop of the second type, which either manufactures in quantity to the customer's order, or has a number of standard lines of its own which can be made to stock. This is the group under which the great majority of machine shops fall and this production *can* be accurately planned.

In future articles of this series I shall show in detail how the planning of production in shops of this kind is done. Each article will take up a single detail of the planning and describe it thoroughly, but first I want to give a bird's-eye view of the method as a whole.

Where the output is made in quantity it is possible by means of time study to tell accurately just how long any operation will take. This, together with the known dates when delivery must be made, gives us the basis on which to work.

When the sales department gets an order, it goes at once to the engineering department which makes up a list of the parts which make up that assembly. If new tools, jigs or fixtures are needed, they are provided in advance. The road is smoothed so that the shop's productive departments need bother about nothing but production. Naturally some of the component parts of an assembly take longer to make than others and therefore must be started sooner. Taking the delivery date as a starting point we work back and find the date on which each part must be started to meet the delivery date. This depends upon the time needed to make the part and the machine capacity available. Now we must make sure that all raw material will be in the plant when needed, so we notify the purchasing agent of our requirements as to quantity and delivery, and follow him up to see that he does as he should. From the time the raw materials come in until the finished product leaves the plant, it is under the control of the planning department—this does away with "buck passing."

The plan so far outlined may seem so rigid that if anything went wrong the whole production would be snarled up. In later articles I shall show just how the necessary flexibility is attained. Suffice it to say now, that between each two lots of parts scheduled to a machine, several hours are allowed as a cushion to take up shocks due to machine breakdowns or other delays in production. Then, too, we generally provide reservoirs of finished and semi-finished parts which will enable assembling to continue for a day or so even should a severe check come in production.

The work is actually given out in the shop by "booth men," there being a production booth for every department or two. They are close to the men and machines and have authority to assign the work to any one of several machines of a kind, depending on conditions. The central planning department thus plans only to operations; the booth to the individual machines. The booth man also attends to moving the material between machines and departments, checks the time of the men and so on.

It is apparent from this brief description that planning consists of two parts.

First, the way is made clear beforehand that the parts can be processed without a hitch. Sufficient machine capacity is provided to handle each operation. The machines are physically arranged so that the parts can be moved from operation to operation with the least possible trucking. That means that the machines, so far as possible, are arranged according to the sequence of operations. The whole shop is put in balance. This planning is preliminary; it is done before an order is taken. Second, each job is planned through the shop, and the road cleared for it so that the machine operators have nothing to do but perform productive operations on the parts. Tools that are to be used are supplied, raw materials needed are purchased and both are delivered to each operator just before he is ready to use them. Usually he does not even have to set up his own tools. The time of starting each job is worked out so that every part which goes into an assembly will be finished in time to get to the assembly floor at the right minute. Planning has a much deeper significance to a business than merely to assure smooth production. The real purpose of planning is to conserve capital so that the rate of turnover will be decreased; that is, so that the time which elapses between the purchase of the raw material and the shipment of the finished product will be a minimum. Obviously, when this time is reduced, a given volume of sales can be handled with a less investment in goods in process.

Most manufacturers are chronic believers that what they need most of all is more capital in their business, and to prove it, point to the business failures, which are usually blamed on lack of capital. It is seldom that you are able to find a manufacturer who can talk about his business for an hour or so without laying emphasis on what he could do if he only had more money.

Yet I firmly believe that most of these men not only do not need more money but would be worse off if they had it. The strange thing is that when considering the getting of more money, they almost invariably think of Wall Street and the banks, rather than realizing that very likely they would be able to pick it out of their own business.

Capital turnover is a subject which is given too little study by the average manufacturer. There is not the space here to elaborate on all of the ramifications of the subject, but the fact remains that if the time taken in manufacturing a given article could be cut in half, the value of the goods in process inventory will likewise be cut in half and the money released from the unnecessary goods in process capital will be additional working capital which may be used

in expanding the business. I could cite innumerable instances of plants where this has been done.

In one machine shop in particular, where we installed a planning system, the results were most striking. At first glance, this concern seemed to be well managed. The machines were well laid out; there was a time-study department of eight men, and nearly every operation in the plant was on piece work. And yet the planning system which we installed reduced the goods in process from $3,000,000 to $1,000,000 in spite of an actual increase in sales. That means that $2,000,000 in cash was picked out of the goods in process inventory and was available for other purposes.

In another concern, making automobile parts, the goods in process inventory amounted to $800,000

with annual sales of the finished product valued at $3,600,000. This meant that the money invested in goods in process was turned over once in 80 days or four and one-half times a year. A production planning system in this plant resulted in cutting the goods in process inventory to $450,000, giving one turnover in 45 days. This, obviously, is a cut of nearly one-half. This concern thought that it was going to have to borrow money to build a new plant in order to meet its possible increased sales. Instead, the planning system enabled it nearly to double its output without additional buildings.

To the casual observer, who might have seen the plant before and after the installation of the production system, it was evident that great changes had occurred, although at first glance it might have seemed that business had seriously fallen off. Where previously the floors of the shop had been cluttered up with partly processed parts, today the shop is clean. There are no accumulations of partly finished pieces at machines waiting for the next operation and no piles of finished parts on the assembly floor awaiting other parts which have not been started.

To sum up, a planning system accomplishes the following results:

1. It enables the sales department to make promises which are reasonably certain of being fulfilled.
2. It reduces the capital needed to handle a given amount of sales.
3. It tends to prevent delays in production. By foreseeing future requirements, it does away to a large degree with emergencies.
4. It relieves the productive departments of the plant from doing non-productive work.
5. It enables the plant to get out the maximum possible production.
6. It tends to keep all machines busy, thus doing away with the heavy loss which an idle machine entails.
7. It reduces the unit cost of the output.

These results are ardently desired by every manufacturer, but are seldom attained. I know of no other way to achieve them except through the medium of a carefully worked out planning system, but I do know that there is not a shop now operating under the hit-or-miss condition which cannot avail itself to a large degree of planning, with the desirable results which I have just mentioned.

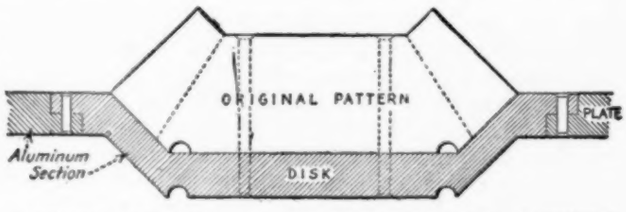
Making a Match Plate Without New Patterns

By H. W. Johnson

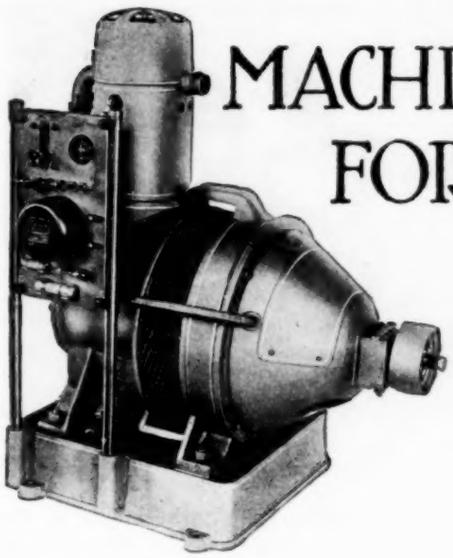
It was decided that a certain small bevel gear could be molded to better advantage from a match-plate pattern than from the hand pattern formerly used. The old patterns had accurately planed teeth and were in fine shape, so the following method was evolved, which made it possible to avoid planing teeth in new patterns.

The first move was to provide a plain aluminum match plate for a 14 x 16-in. flask. This plate was planed ⅜ in. thick and centers were laid out for four patterns. Meanwhile, four aluminum disks were cast and turned up in the lathe—one side being a duplicate of the back of the gear pattern, the other side bored out so the old patterns would fit down as far as the points of the teeth. The thickness of this disk was such that the total over-all thickness of the assembled pattern and disk was ⅜ in. greater than the original thickness of the pattern, to allow for the plate. To attach the disk to the plate, each disk was provided with a stepped flange, very much like a stove lid, and the plate was bored to fit. Finally, the disks were riveted through the flange to the plate with small rivets.

Of course, the impression could have been turned directly in the large plate, and the use of the little disks avoided, but I believe that the greater speed and ease of turning the small disks rather than the large plate paid for the small amount of extra work occasioned by inlaying the disks. The plate was bored by means of a sweep tool in the drilling machine.



METHOD OF MAKING THE MATCH-PLATE PATTERN



MACHINING THE GAS ENGINE FOR A LIGHTING UNIT

By J. V. HUNTER
Western Editor, *American Machinist*

The manufacture of small power internal-combustion engines has been highly specialized for several years with strong competition in all lines, and to make a success of it close attention must be given to using the most practical methods of machining. This article, the first of a series, details many of the methods which are being developed by one very successful manufacturer of this line of power units.

THE introduction of small power engines to meet the needs of modern farm life has led to various methods for driving electric generators for lighting isolated dwellings. Some lighting units have been belt driven from standard engines, but the demand for a compact, self-contained unit has been insistent and several different units of this type have been developed.

Recently several large manufacturers from different fields have combined to produce the parts required to make up a lighting unit which includes the prime mover, the generator, the storage battery and the automatic switchboard controller. This unit combines a single-cylinder kerosene engine which is direct-connected to a 1½-kw. generator, and operates in connection with a storage battery. The battery furnishes current when the unit is not operating and also operates the generator as a motor to turn over the engine for the purpose of starting.

The engine starts and runs on gasoline until warm and requires personal attention for priming and starting, but is provided with an automatic control to stop it when the batteries are fully charged and the current consumption has been shut off. The automatic switch will also open the circuit if anything happens to seriously retard or shut down the motor.

The Engine Is a Single-Cylinder Unit

The gas engine for this unit, shown in the headpiece, is made by the Fuller & Johnson Manufacturing Co., Madison, Wis., and has one vertical cylinder. The lubrication is by splash from an oil chamber in the crank case and the fuel storage is in the hollow chamber of the main base. The engine is air cooled by a blast drawn through the perforated cover over the cylinder, passing down over the cooling flanges into the flywheel chamber and expelled by a centrifugal fan which is cast as an integral portion of the flywheel.

An interesting feature of the machining operations on this engine is the fact that a large majority of the parts are handled on turret lathes and some exceptional holding fixtures have been devised for supporting the irregularly shaped castings. An example of this is the first operation on the crank case which is performed

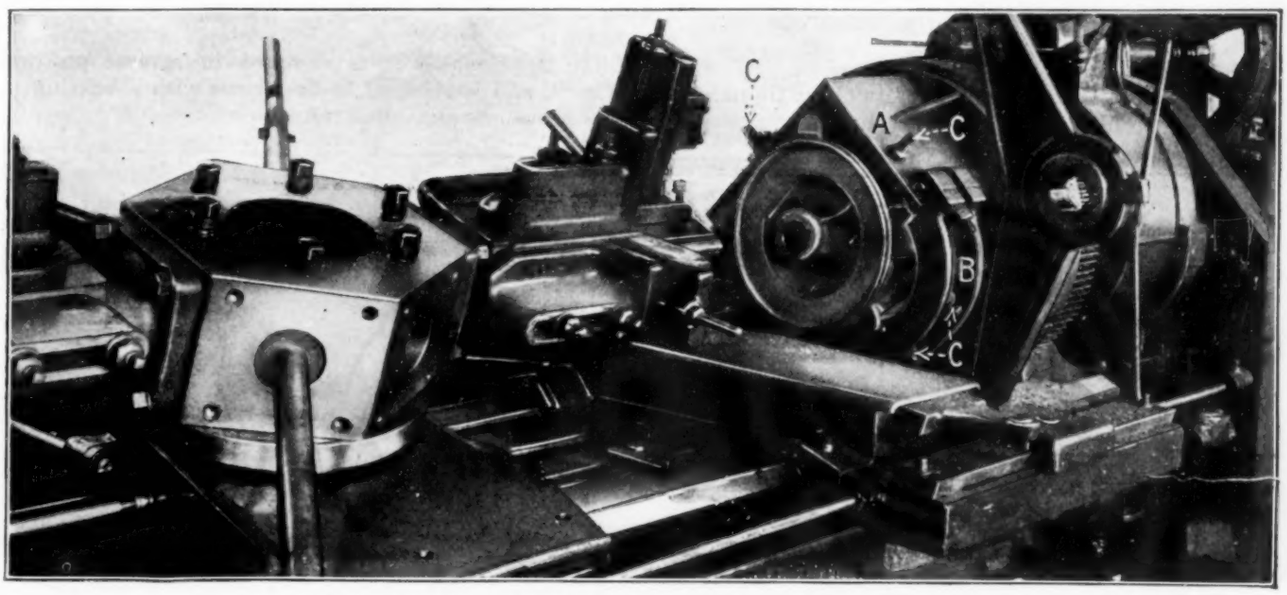


FIG. 1. FACING AND BORING FLYWHEEL SIDE OF CRANKCASE

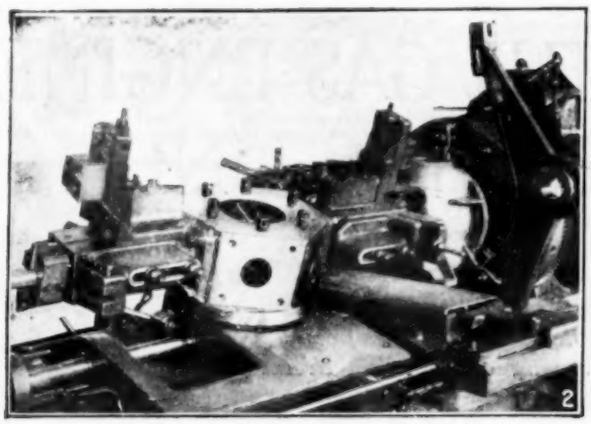


FIG. 2. FACING GEAR SIDE OF CRANKCASE

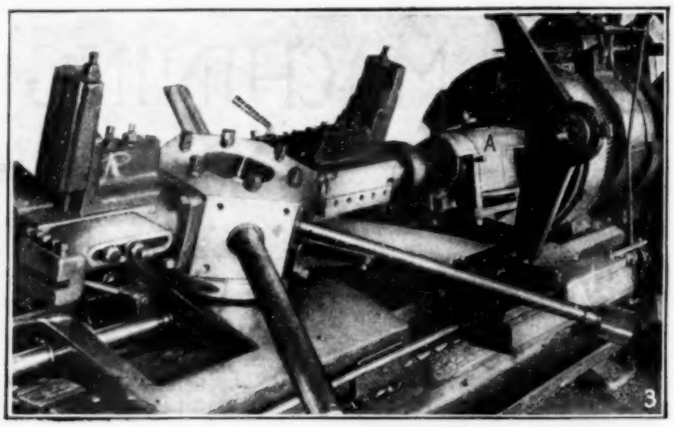


FIG. 3. BRACKET FIXTURE FOR FINISHING CYLINDER SEAT

on a Gisholt turret lathe, Fig. 1, while the casting is held in the heavy cage-like fixture *A*. The arm *B* is hinged at the back and can be swung away from the box section while the casting is being slipped into place. After this arm is replaced the various setscrews *C* are tightened to insure a firm hold. There are five turret and two tool-post tools used for finishing the flywheel side of the crank case and a number of the tools are shown in the illustration. The crank case then passes to a second lathe upon which it is mounted in reverse position, Fig. 2, and is clamped to the chuck with a bearing on the previously machined face.

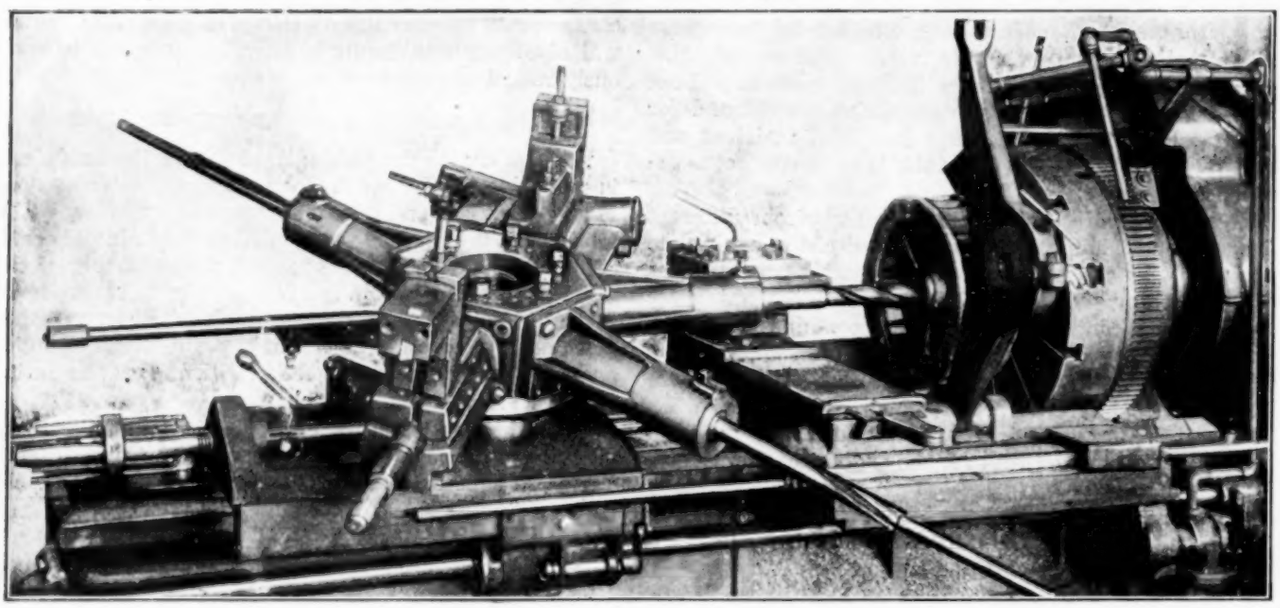


FIG. 4. COMPLETE SET-UP FOR FINISHING SIDE AND BORE OF FLYWHEEL

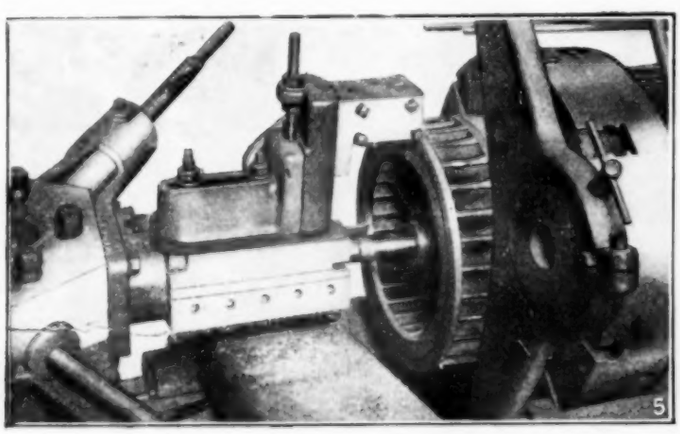


FIG. 5. DETAIL VIEW OF FLYWHEEL RIM-TURNING OPERATION

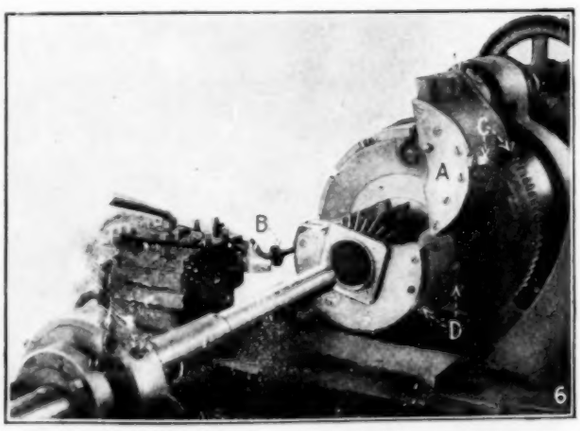


FIG. 6. ROUGH-BORING AND FINISHING BASE OF CYLINDER

The facing and boring of the seat for the cylinder is handled on a Gisholt turret lathe, Fig 3, while the casting is supported from the headstock by a heavy bolted-on bracket fixture *A*. This bracket fixture is designed to be so rigid that there will be no vibration or strain of the casting to cause irregular machining.

Turret-Lathe Work

Most of the boring, facing and turning of the flywheel hub is accomplished on the turret lathe, Fig. 4. After the engine side has been finished, the position of the flywheel is reversed in a second turret lathe and the generator side is faced off with carriage tools. The

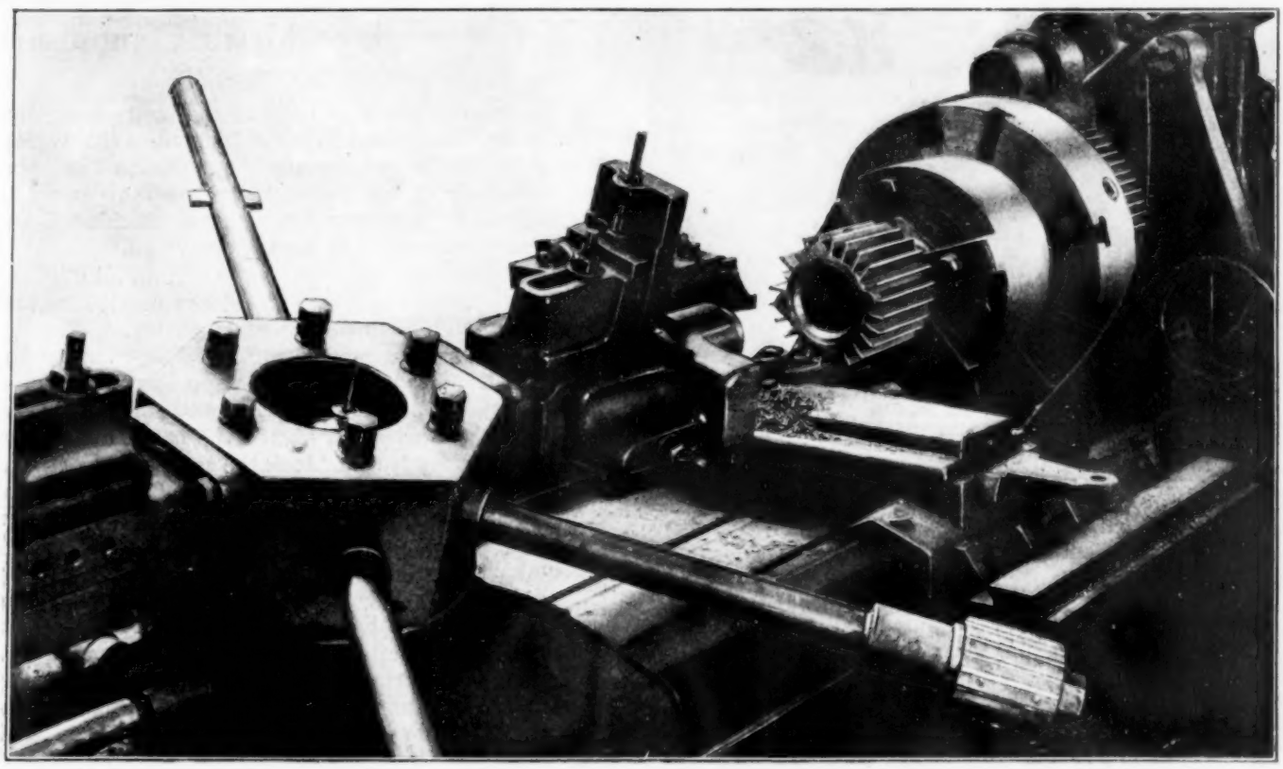


FIG 7. FINISH-BORING AND FACING HEAD OF CYLINDER

operations in the first series include boring, turning and facing the hub, and facing and turning the outside rim of the wheel to insure clearance and smooth running in the generator housing. One of the rim-turning tools in operation is shown in greater detail in Fig. 5.

Cylinders Completed in Two Series

The cylinders are completed in two series of turret-lathe operations; the first of these, Fig. 6, rough-bores and finishes the base. To hold the cylinder a heavy cage-like fixture is mounted on the faceplate, and is provided with a hinged top *A* which may be raised for placing and removing the work. In service this hinged top is locked down by swinging the side-bolts *B* and the casting is further clamped by tightening the set-screws *C* and *D*.

A similar operation, Fig. 7, finish-bores and faces the top to receive the head. It is the practice in this shop to make a very accurate job of the finish-reaming on the cylinder bores and thus avoid the necessity of internal grinding of this part. The finish-reamers are, therefore, maintained to very close limits of accuracy.

Rolling Threads on Container Caps

By Edward Dede

I read with interest the article under the above title on page 111 of the *American Machinist*. I wish to make a few remarks on this article referring to moldmakers.

Mr. Hand states that the moldmaker cuts the thread with a tool he judges near right. He is wrong. From my thirteen years' experience I have learned it is to a moldmaker's advantage to grind his tool as near accurate as possible, for when the threaded ring is completed the sample container or model must lie in it as nearly perfect as can be. In making gages for their tools most men do so as follows:

If the thread on the sample container is blown out to the right diameter or a full thread, he takes an impression of it and grinds the tool to fit; but, on the other hand, if it is not a full thread, he takes an impression inside of the container cap, which most generally comes with a sample container, and then takes an impression of the one taken from the cap.

He does not cut the thread until he thinks it is deep enough. Twenty-five years ago moldmakers used calipers, but today they use micrometers. He cuts near the depth, then makes a lead cast and tries on the cap; if it is not deep enough then he cuts more out. But he uses the cut-and-try methods only on the first one, for then his lathe is set and can make a thousand or more with no more lead casts.

For containers that have threads that the glass manufacturers have made before, they need no cut-and-try methods as the size is already known.

Mr. Hand is correct in his statement about the cold mold, but the container is not taken out of the mold

when too hot. Bottle machines are timed and the container is retained in the mold a certain time to cool.

When the nature of the glass changes, is when everything goes wrong; it may get heavy or light in weight.

In making a bottle the glass taken from the tank is in a ball and it is put in a blank to make the glass in oblong shape before being put in the mold. Blanks are bored to a diameter to contain sufficient weight of glass for the bottle.

I have seen these work perfectly for weeks, when, all at once, the nature of the glass would change and make necessary the boring of these blanks larger three and four times in one day, as otherwise they would not hold enough glass to get the correct weight. Then the thread on the container is small. It is better to see if you are right, then go ahead for there is no remedy for an unaccepted bottle but melt it over.

If Mr. Hand refers to standardizing the threads on containers, then that would be a great improvement. But to standardize the moldmakers' methods is impossible at the present day as production is the main feature in a mold shop.

[The author of the article referred to is glad to learn of a moldmaker who is using some system in his work. The statements in question were made on the authority of several moldmakers visited when obtaining data for the article.—S A. HAND.]

Selective Hardening Kinks

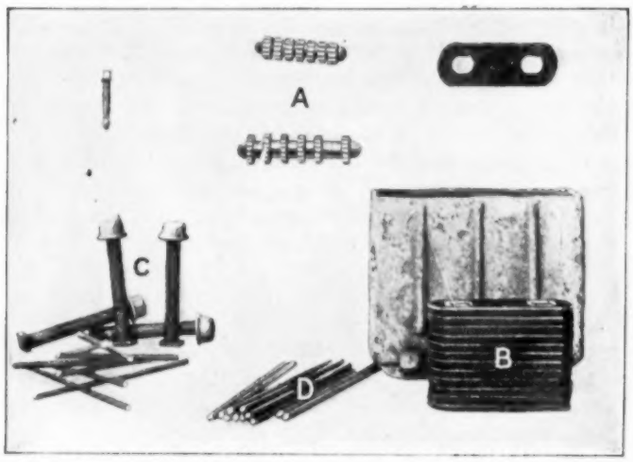
BY W. H. ADDIS

Selective hardening is sometimes called local hardening and consists of hardening certain portions of dies, tools or other parts, and leaving the rest soft. It may be done in many ways, some of the more successful of which are mentioned in what follows.

At *A* in the figure are two strings of gears which have been bolted together by passing bolts through the bore. The bolt heads and nuts are then coated with fireclay, the caps of clay being of sufficient size to protect the bore of the gears. In this way the bore of each gear remains soft while the teeth and body are hardened.

The chain side bars at *B* are to have the outside edges and the inside of the pitch holes case-hardened while the sides are to be left soft. To accomplish this the bars are placed in the pot stacked just as they appear at *B* and the carburizing compound is packed around them and in the pitch holes.

One firm uses the cull stampings from tomato-catsup-bottles caps for covering the threaded ends of bolts while they are being hardened. In another plant, sheets of tin are placed over the area to be left soft and coated with fire-clay. Still another way of protecting the soft parts is to coat them with a special paint. At *C* and *D* are shown bolts and silent chain pins which have had the ends dipped in such a paint.



PARTS PROTECTED FOR SELECTIVE HARDENING

Two very good formulas for protecting paints are as follows: Mix equal parts of asbestos flour and 42-deg. sodium silicate to the consistency of a heavy paint and apply by dipping or painting. The work should be warm, dry and free from grease. The other paint differs only in the substitution of kaolin for the asbestos flour. Both of these paints were largely used on war work with consistent success.

A Clinical Angle on Metric Compulsion

BY GEORGE G. LITTLE, M.E.

In the last five years as head of the instrument shop of the Mayo Clinic (the largest of its kind in the world), the opportunity for me to study the application and possible advantage of the use of metric measurements in designing and building instruments, machines, and laboratory apparatus has been exceptional.

I have met professional and laymen from all over the world with whom I have discussed the possible advantages to be had by using the metric system.

There is a surprising lack of knowledge among the professional and laboratory men regarding the amount of time, labor and expense consumed in production.

None of those who had signed the cards distributed by the "World Trade Club" took the trouble to learn who is causing the agitation, or to reason out what the results would be to our industries should the bill now pending become a law.

None have been able so far to convince me positively that the metric system has any advantage whatever over our present method of applying the English inch.

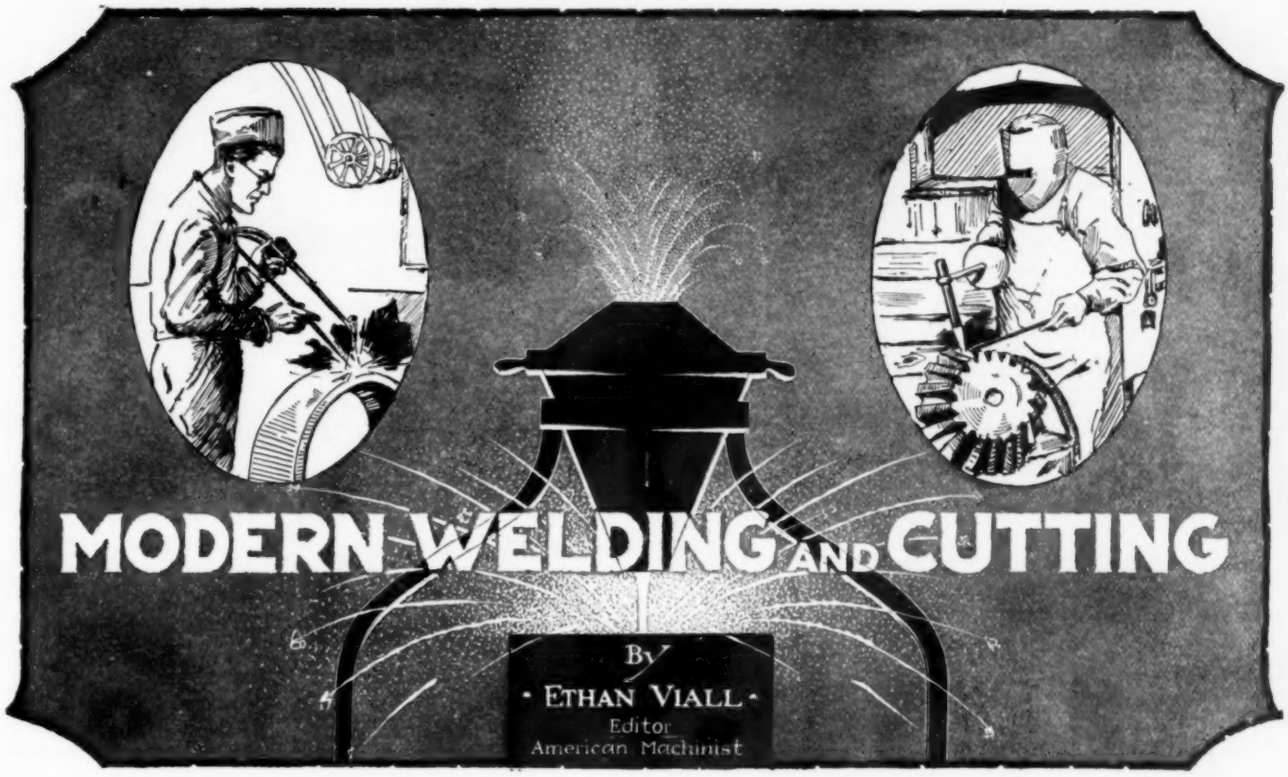
While it is sometimes required that we construct apparatus and instruments to metric measurements we have found no advantage in doing the work, making due allowances for non-metric sizes of material and tools used in such work.

The one big point those in favor of the metric system dwell upon is that it is so much easier to convert small units of measure into a large unit, or units, or large ones into smaller ones, by the transposition of the point. Also, when expressing a liquid or solid quantity that it is easier to say so many c.c.'s or m.m.'s, instead of expressing some fraction of an inch. None of them seemed to be unbiased in their convictions that the metric is better than the English system.

One man alone upon learning from me what the results would be in our industrial world and just how it would affect him in his profession (surgical) stated that he hoped the bill pending would not be passed and that he would surely do what he could to prevent it.

None are aware of the conditions obtaining today in France in the use and non-use of the metric system, or that it makes no difference in the sale of machines, that they are constructed according to the inch system.

The boosters of the metric bill are professional and theoretical and laboratory men who have no dealings with, nor thought of, the welfare and requirements of the industries of this country. Those who know what damage it would cause have no desire to see the bill become a law.



XXI. Welding Machines*

A majority of welding machines are built for straight-seam work, but a few have been developed for circular or irregular seams. Examples of both classes are shown.

(Part XX appeared in our March 25 issue.)

GAS-TORCH welding machines with automatic feed are used for a large variety of work, although straight-seam welding is the more common. In this latter class of work are included sheet-metal-cylinder side-seam welding and pipe or tube welding.

A welding machine known as the Duograph, is shown in Fig. 251. This machine was made by the Davis-Bournonville Co. and was especially designed for welding the seams of steel drums or containers, insuring a mechanical weld uniform in appearance and efficiency. It comprises a turret-top holding device with water-cooled arms and clamps for holding the steel drums in position, permitting the work being placed in position for welding on one set of arms while the work on the opposite set of arms is being welded. The turret top is then swung half around, the welded work removed and another job set up.

The gas-torch carriage is moved forward at a fixed

*For the author's forthcoming book, "Welding and Cutting." All rights reserved.

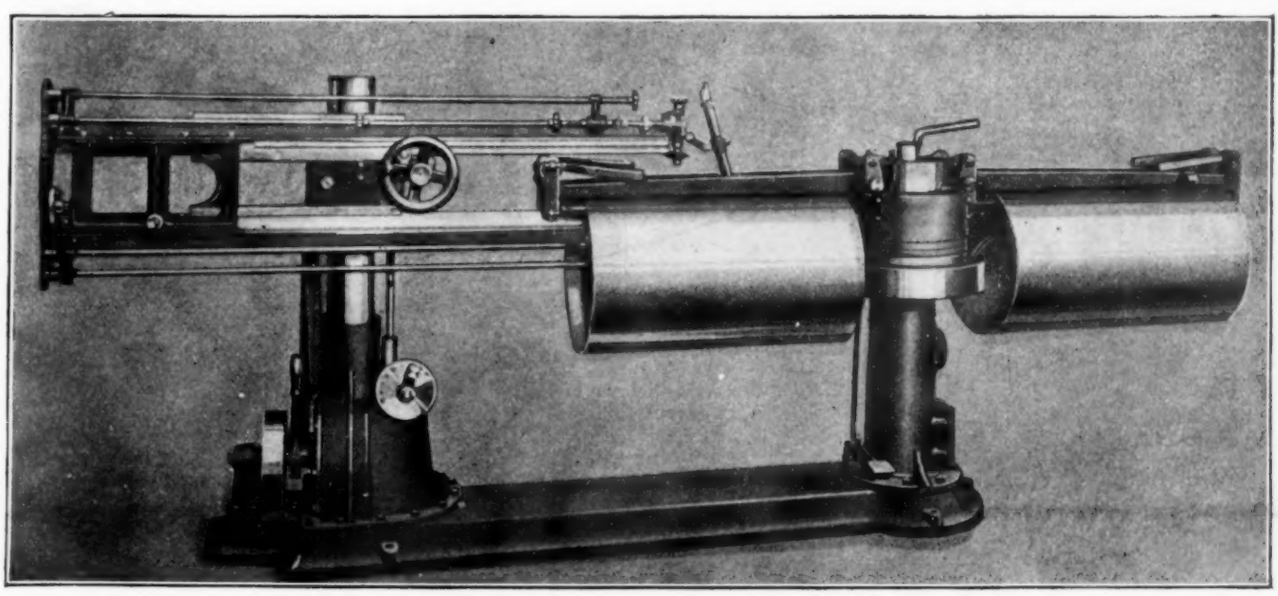


FIG. 251. DAVIS-BOURNONVILLE DUOGRAPH WELDING MACHINE

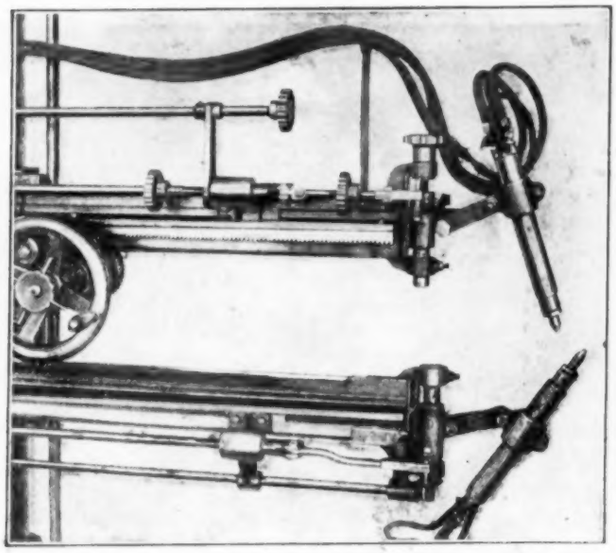


FIG. 252. TORCH ARRANGEMENT ON THE DUOGRAPH

speed by power, belt driven, and is reversed by means of a handwheel when the weld is finished. Various speeds for different thicknesses of metal are obtained by the use of cone pulleys. The carriage is fitted with two torches—one above, the other below—as shown in Fig. 252, for welding both sides of the seam simultaneously. For very light welding, one torch only is required. Water-cooled welding torches are used. The No. 1 machine will weld a 36-in. seam, and will take containers from 12-in. to 36-in. in diameter. The No. 2 machine welds a 54-in. seam. An average speed of welding of 18-in. per minute is obtained on 16-gage sheets.

Fig. 253 is a close-up of a man putting a sheet-metal drum into position on one of the turret arms. Fig. 254 shows the drum clamped down and swung into place ready to be welded. This illustration gives a good idea of the operating mechanism. Fig. 255 shows the seam weld completed and ready to be removed.

A much simpler machine is shown in Fig. 256. The operation of the feeding mechanism is obvious.

A smaller, though very similar machine, is shown in Fig. 257. While the work shown in position is cone shaped, cylinders may be held as well.

The machine shown in Fig. 258, is for welding bottoms onto tea kettles, cans, drums or other circular work.

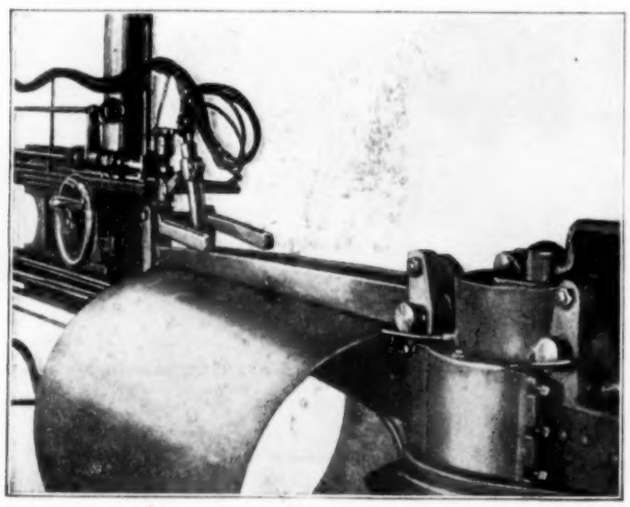


FIG. 254. DRUM IN POSITION READY FOR WELDING

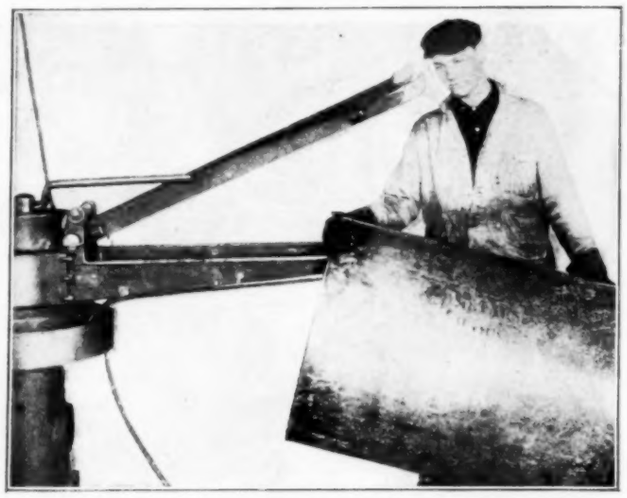


FIG. 253. PUTTING A DRUM ONTO A TURRET ARM

The machine is so made as to allow for a considerable range of adjustment for different sizes of work.

A machine developed at the plant of the Edison Storage Battery Co., Orange, N. J., for welding bottoms in storage-battery cases, is shown in Fig. 259. This machine was first described in the *American Machinist*, Aug. 10, 1911. The bottom to be welded in is made of sheet steel with upturned edges. A four-part expanding form is placed within the edges of the bottom and locked by turning down the screw shown in the center of the case. With the bottom and expanding form in place as shown, the case is "shrunk" to it and sized by turning the eccentric lever *A*. The gas torch *B*, which is hinged at *C*, is then swung down into welding position and so set as to throw the flame correctly onto the upturned edges of the bottom and the case. The motor is then started and the feed thrown in by means of lever *D*.

This lever operates a clutch on a shaft carrying a pinion meshing with the oblong gear on the bottom of the frame which supports the case. This moves the frame and the seam to be welded along under the welding flame. When a corner is reached the trip *E* throws the lever *F* and slips the clutch *G* into contact with the upper teeth, increasing the speed of the driving pinion

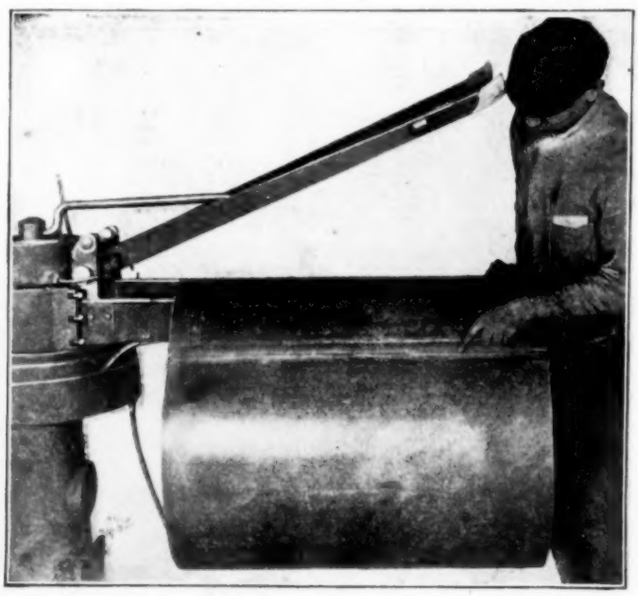


FIG. 255. THE FINISHED SEAM WELD

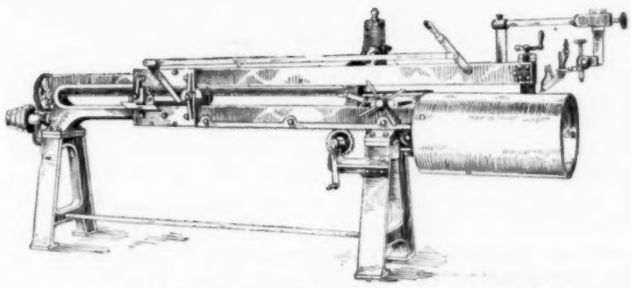


FIG. 256. HEAVY DRUM WELDING MACHINE

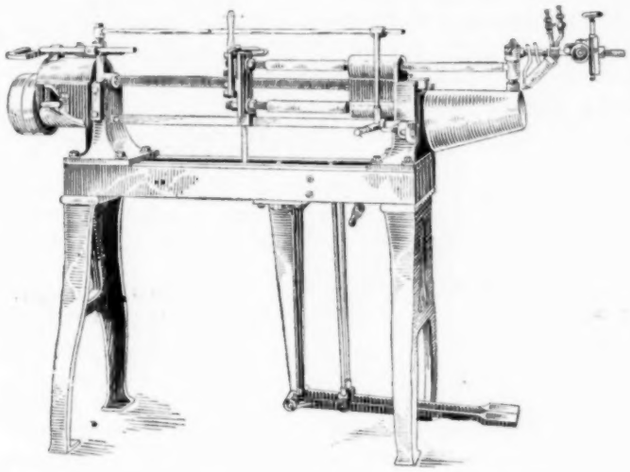


FIG. 257. LIGHT SEAM WELDING MACHINE

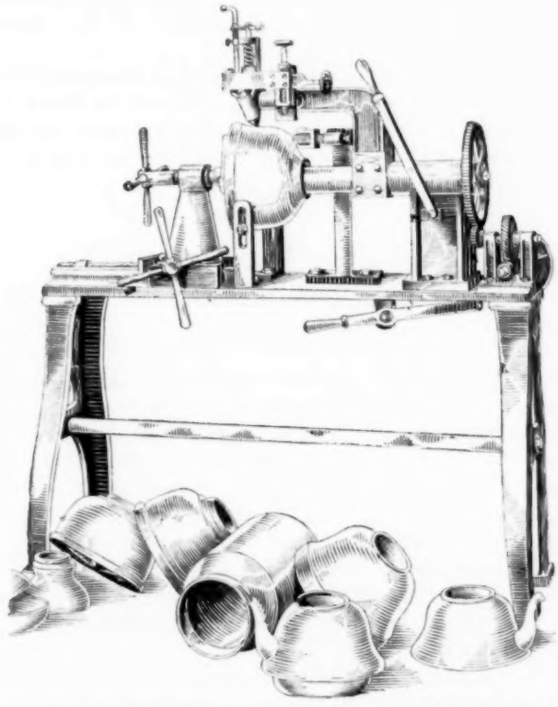


FIG. 258. MACHINE FOR WELDING CIRCULAR SEAMS

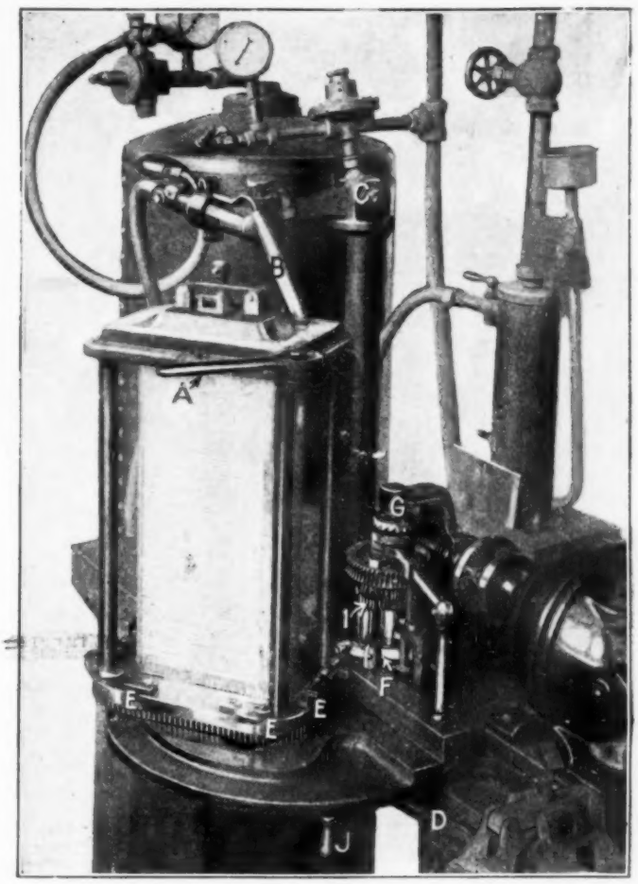


FIG. 259. MACHINE FOR WELDING OBLONG SEAMS

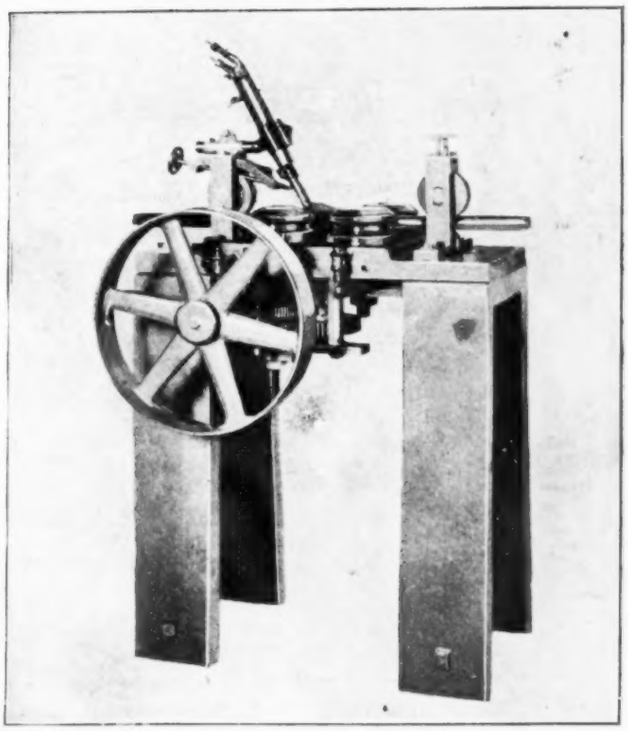


FIG. 260. SINGLE-TORCH TUBE WELDING MACHINE

so that the seam being welded moves at the same speed under the flame while turning the corner as while being driven along the straight seam. As soon as the corner has been turned the lever *F* is forced down by another trip and the sun-and-planet gearing *I* again comes into play, giving a slower movement as the straight part of the seam is fed under the flame. For bringing the mechanism back to the starting point, the handle *J* is used. A single-jet tube welding machine made by the Thermalene Co., is shown in Fig. 260. Views of a double-torch machine made by the same concern, are shown in

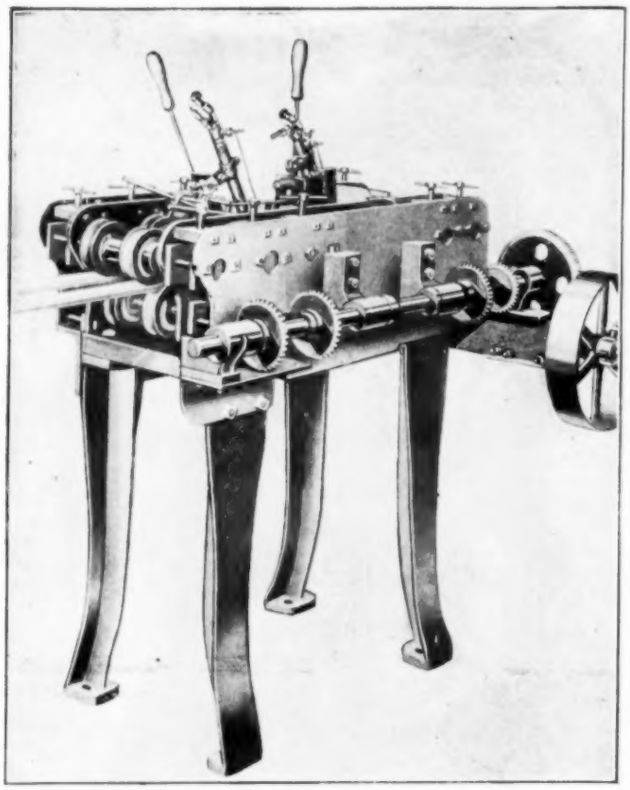


FIG. 261. DUPLEX TUBE WELDING MACHINE

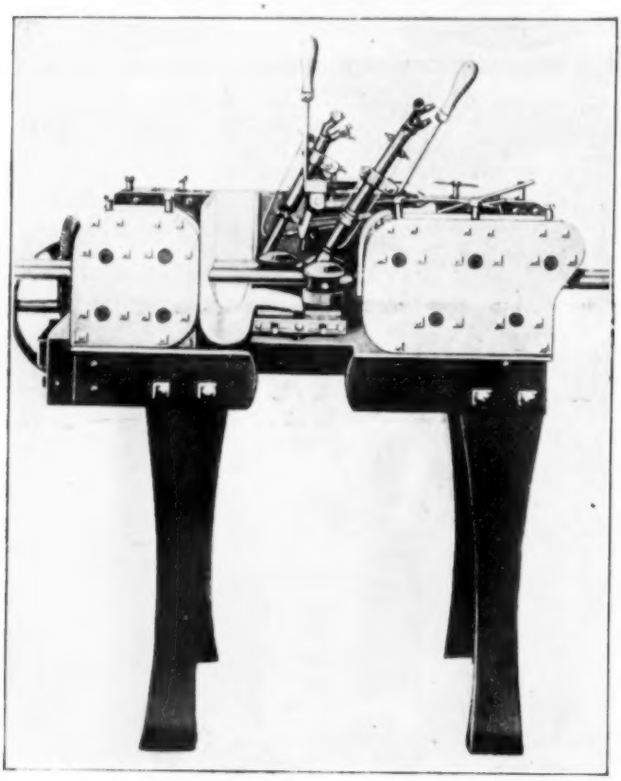


FIG. 262. ANOTHER VIEW OF DUPLEX MACHINE

Figs. 261 and 262. In a general way, these are typical of all machines designed to butt-weld formed tubes. For further information on tube welding machines and methods, the reader is referred to the article by F. W Smith on page 845, Vol. 51, of the *American Machinist*. This explains the process in a practical way.

The Trials of Old Baldy—II

By A. R. Durant

One day "Andy," a recent acquisition of the Ajax Works, was facing off a lot of cast-iron disks. It was getting toward noon and it began to look as if the one in the chuck was going to be finished a little too soon to allow him to wash up comfortably while the feed was running, so he unlocked the crossfeed and began to nurse the tool slowly along by hand.

A few minutes before 12 o'clock Old Baldy, the boss, "happened" along, and told Andy to take the apron off the lathe carriage and put it on the bench before noon. He would be told what was to be done with it later.

Andy was pretty mad, but by dint of much sweating and profanity he got the apron off and onto the bench just as the whistle blew, but he wasn't washed up. Oh no!

When he came back from dinner he asked Old Baldy what was to be done with the apron, and the boss replied, "put it back on the lathe and go ahead with your job."

Andy put the apron back (anybody who has accomplished this job knows just what a soothing and soul-satisfying operation it is) and after grinding and setting the tool, gave the crossfeed knob a whirl and sat down on a box prepared to take a good rest while the tool was feeding across, but there seemed to be a hitch somewhere; the tool was not moving. Andy, with a muttered cuss-word, got up and gave another yank to the knurled knob that locked in the crossfeed; still nothing happened. Andy turned around to find Old Baldy at his elbow. "Something's the matter with this damn crossfeed," he says.

"Yes," replied Baldy, "I took out one of the gears this noon. I saw you enjoyed feeding the cut by hand so much that it would be a shame to deprive you of the pleasure and I decided to fix the lathe so you could do it that way all the time."

Bell Cranks for Transmission of Uniform Motion

By W. B. Greenleaf

Referring to the article under the above title published on page 460 of the *American Machinist*, it strikes me that Mr. Sullivan is incorrect in his figuring.

In the first place with the ordinary arrangement of connecting the links to the bell crank by pins the motion is not uniform. This can readily be seen if the rectangular motion be carried out to the point where the bell crank travels through 90 degrees. In that case the circular motion would cease altogether, as the force of the link would be pushing directly against the axle of the bell crank.

Further I cannot see any advantage in equality of motion for the rounded surfaces on the bell crank, although they would, of course, maintain the application of the power at the same point during the whole of motion. There would be no advantage over the flat surfaces, for while it is true that the length of the radius would vary, it would vary by exactly the same amount at both ends of the crank, so that while the value of the leverage would change, it would change in an equal amount at both the receiving and transmitting ends.

Tap-End Sizes of Studs

SPECIAL CORRESPONDENCE

Studs must fit tight on one end and allow nuts to be easily screwed on the other. Should the tap end be tight on the thread or depend on being jammed on the last thread? This article gives the practice of two of the large companies making studs for the market.

THE Chicago Screw Co., through the courtesy of its secretary, Edw. H. Ehrman, gives the following information:

It is the practice of many screw companies, this company included, and also a great many customers, to round the nut ends and to chamfer the tap ends of studs, for several good reasons, and there is much to be said in favor of this practice.

(a) The rounded end serves to indicate a finger fit, as it is common practice to round the ends of bolts and capscrews which are either in the loose- or medium-fit class.

(b) The rounding, if made to a circle 1½ diameters, presents a neat appearance after assembly, even if there is considerable variation in the position of the nut relative to the end of the stud. Inasmuch as studs cannot, without difficulty, be uniformly "set," this feature has more than a casual value.

(c) It has been our experience that it is easier to produce the rounded shape either with the shaving tool or the cutting-off tool, than it is to produce a flat and chamfered end. Conversely, it is just as easy, and perhaps easier, to chamfer the unfinished end of the stud before it is severed by the cutting-off tool, and the stud may be severed with less burr than is possible if this end is rounded.

(d) Rods that are threaded on both ends to a finger fit should have the ends rounded to indicate that neither is a tight or wrench fit. This practice is as important to the manufacturer as to the user.

The illustrations give pitch-diameter limits that have proved very satisfactory in practice. Fig. 1 gives limits suitable for studs to be set in heavy sections such as those in steam pumps and engines; also for a few special studs. Fig. 2 gives limits suitable for studs to be set in light sections, such as those in gas, gasoline engines, etc.

The rationale of these two series of limits is based on practical conditions obtaining at the time of their formulation.

Steam Pump Studs

The thread limits given in Fig. 1 are such that the studs should be wrench tight in tapped holes produced in a manner that is customary in the manufacture of steam engines, steam pumps and other heavy machinery, and with commercial taps of average size. While this series was formulated over seven years ago, there has been no complaint or comment from customers to indicate that either the tolerances or the negative allowances are great. We are inclined to believe, however, that this table will shortly need revision, on account of the increasing tendency of the mean size of commercial taps to run closer to basic size.

On account of the lighter sections in which studs are set, the character of the material, the (presumably) greater care exercised in the selection of taps, and in their use, the negative allowances are made materially less than in the case of steam-pump studs. There are several factors that might be mentioned that affect both the tolerances and negative allowances. Among these may be cited:

(a) The use of soap water tends to make the tap cut closer to its size than does lard oil.

(b) The yielding of light sections, especially if of non-ferrous metal (particularly if the tap is dull and

TAP END

PITCH DIAMETER

REGULAR

SIZE	AMT. OVER SIZE	V THD. MAX.	V THD. MIN.	SIZE	U.S.S. THD. MAX.	U.S.S. THD. MIN.
¼ 20	+0035 +002	.2145	.2130	¼ 20	.2211	.2196
5/16 18	+004 +0025	.2732	.2717	5/16 18	.2805	.2790
⅜ 16	+0045 +003	.3308	.3293	⅜ 16	.3389	.3374
7/16 14	+005 +0035	.3868	.3853	7/16 14	.3961	.3946
½ 13	+0055 +004	.4456	.4441	½ 13	.4556	.4541
½ 12	+0055 +004	.4405	.4390	½ 12	.4514	.4499
9/16 12	+006 +004	.5036	.5016	9/16 12	.5144	.5124
5/8 11	+006 +004	.5602	.5582	5/8 11	.5720	.5700
¾ 10	+0065 +0045	.6786	.6766	¾ 10	.6916	.6896
⅞ 9	+0075 +0055	.7959	.7939	⅞ 9	.8104	.8084
1 8	+0075 +0055	.9101	.9081	1 8	.9263	.9243
1⅛ 7	+008 +006	1.0220	1.0200	1⅛ 7	1.0400	1.0380
1¼ 7	+0085 +006	1.1471	1.1446	1¼ 7	1.1657	1.1632
1⅜ 6	+009 +006	1.2541	1.2511	1⅜ 6	1.2758	1.2728
1½ 6	+009 +006	1.3791	1.3761	1½ 6	1.4008	1.3978
1⅝ 5	+0095 +0065	1.4786	1.4756	1⅝ 5		
1⅝ 5½	+0095 +0065			1⅝ 5½	1.5164	1.5134
1¾ 5	+0095 +0065	1.6036	1.6006	1¾ 5	1.6296	1.6266

SPECIAL

SIZE	V THREAD MAX.	V THREAD MIN.
5/8 12	.5661	.5641
11/16 12	.6286	.6266
¾ 12	.6916	.6896
13/16 12	.7541	.7521
⅞ 12	.8176	.8156
1 12	.9426	.9406

FIG. 1. PITCH-DIAMETER LIMITS OF STUDS FOR HEAVY SECTIONS

requires lubricant, such as soap water), contributes to undersized holes.

(c) The selection of taps close to the basic size tends to make the mean size lower than the mean size of the general run of commercial taps.

In threading studs the ordinary way, by means of opening dies or bolt cutter heads, there are many little things that tend to produce threads that have a slight general and irregular taper.

(d) The lack of straightness, rotundity, etc., of the stud blank itself, if of "hot-rolled steel," makes it difficult to chuck in proper alignment with the die.

TAP END PITCH DIAM. STUDS
Gas Engine Std.

Recommended only where careful attention is given to selection of taps.

LIMITS		V-THREAD		U.S.S-THREAD		SAE-THREAD	
Size	Limits	Size	Max & Min P.D.	Size	Max & Min P.D.	Size	Max & Min P.D.
1/4	+.0025 +.001	1/4 20	.2135 .2120	1/4 20	.2201 .2186	1/4 28	.2293 .2278
5/16	+.0025 +.001	5/16 18	.2717 .2702	5/16 18	.2790 .2775	5/16 24	.2879 .2864
3/8	+.003 +.0015	3/8 16	.3293 .3278	3/8 16	.3374 .3359	3/8 24	.3509 .3494
7/16	+.0035 +.002	7/16 14	.3853 .3838	7/16 14	.3946 .3931	7/16 20	.4086 .4071
1/2	+.0035 +.002	1/2 12	.4385 .4370	1/2 13	.4535 .4520	1/2 20	.4711 .4696
9/16	+.0045 +.0025	9/16 12	.5020 .5000	9/16 12	.5129 .5109	9/16 18	.5109 .5281
5/8	+.0045 +.0025	5/8 11	.5587 .5567	5/8 11	.5702 .5686	5/8 18	.5935 .5915
3/4	+.0045 +.0025	3/4 10	.6766 .6746	3/4 10	.6896 .6876	3/4 16	.7139 .7119
7/8	+.005 +.003	7/8 9	.7934 .7914	7/8 9	.8079 .8059	7/8 14	.8336 .8316
1	+.0055 +.0035	1 8	.9081 .9061	1 8	.9243 .9223	1 14	.9591 .9571

FIG. 2. PITCH-DIAMETER LIMITS OF STUDS FOR LIGHT SECTIONS

(e) Wear in the die head, and in the vise, or chuck, causes mis-alignment with respect to both parallelism, and angularity, either of which conduces to tapering threads in the product.

(f) The dullness of the die chasers at the throat and looseness of fit of the chasers in the head tend to produce threads that are tapering near the shoulder.

(g) The first two and possibly three threads are quite apt to be tapering as they are produced before the die is advanced far enough to equalize the cutting load on the several chasers.

In tapping holes by machine the following factors contribute to the production of tapering threads:

(h) Greatest wear of the tap nearest the end.

(i) Mis-alignment of tap shank with the threads.

(j) Mis-alignment in tapping machine.

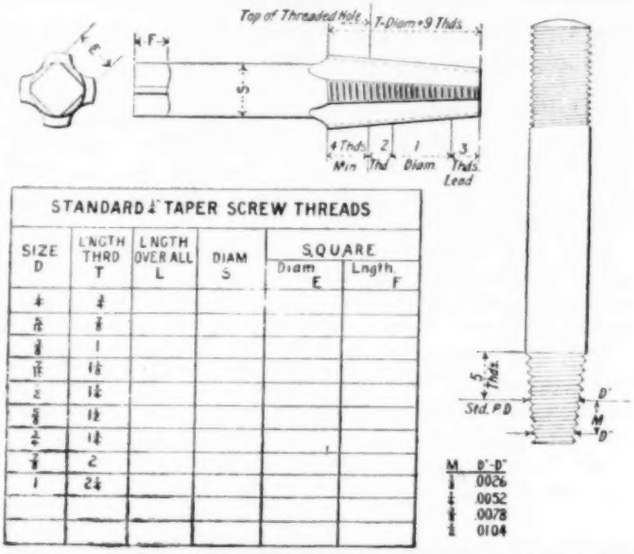
TAPER THREADS IN ASSEMBLING

The taper in the thread in the product, as a result of one or more of the conditions just noted, need be but a very few thousandths of an inch in the used length of thread to create a situation in assembling, akin to that existing in a pipe-thread joint, although of much less taper. The tendency of the threads to be tapering has prompted a few manufacturers to make them designedly so. Several tapers have been used ranging from $\frac{1}{8}$ to $\frac{1}{4}$ in. per foot (0.0104 to 0.0208 in. per inch). The coarser taper answers well for thread lengths not over $1\frac{1}{2}$ diameters long, while the slighter taper is suited to great thread lengths, possibly up to three diameters in length.

A tap, or die, having ten threads per inch and tapered 0.12 in. per foot (0.01 in. per inch) would increase the diameter of the hole 0.001 in. per turn (or the radius 0.005 in. per turn). The depth of the "cut" at the crest and root of the thread is therefore 0.0005 in. and at the slopes of the thread 0.00025 inch.

Tapered threads are so much better suited to tight, or wrench-fit work than are "straight" threads, that it is strange that their use has not been extended further than the making of pipe joints.

It is our belief that the making of wrench-tight fits would become simplified rather than complicated



STANDARD ¾" TAPER SCREW THREADS

SIZE D	LNGTH THRD T	LNGTH OVER ALL L	DIAM S	SQUARE Diam E	SQUARE Lngth F
¼	¼				
⅜	⅜				
½	1				
¾	1⅛				
1	1⅛				
1¼	1¼				
1½	1½				
1¾	1½				
2	2				
2½	2¼				

M	D'-D"
¼	.0026
⅜	.0052
½	.0078
¾	.0104

FIG. 3. STANDARD THREADS FOR SCREWS ¾ IN. TAPER PER FOOT

through the use of tapered threads. The "good points" in this practice that appeal to us are:

(k) The hole size is determined by tapping to the proper depth and so is under accurate control of the operator (diameter changes 0.01 in. for each 0.1 in. change in depth).

(l) The diameter of the tapped hole is thus under the control of the manufacturer, so that the desired tightness of fit, of uniformly threaded studs, in metals of widely different characteristics may be secured.

(m) The dimensions of the tap-end thread on studs may be standardized and uniform, so that but one series is necessary.

(n) The diameter of the tap-end taper thread can be such that the stud will satisfactorily assemble in a tapped hole produced with a straight tap in the present customary way, Fig. 3, and vice versa, so that interchangeability need not be disturbed during the period of transition from the so-called straight to taper thread standard.

(o) The initial assembly is facilitated by the taper.

(p) The tightness of fit of the assembly is under closer control, with tapered threads, so that the make-up is more uniform than is possible with straight threads made with the same degree of skill.

The usefulness of taper-threaded studs is indicated by the fact that several concerns that have adopted and continued their use (in some instances for more than 15 years) have found them preferable to straight-threaded studs.

It is our belief that the use of a taper in making

tight fits and joints is much more logical than trying to make tight straight fits in the usual way.

This is conceded in the case of pipe joints, and we believe that before many years pass, the use of straight threads for studs will become obsolete. The application of taper threads is not confined to the Brigg's standard, but includes well-casing threads, plumber's-tubing threads, boiler-stud threads, and other taper threads.

The use of a slight taper for pressed fits, and in lieu of cylindrical pressed fits, is finding favor with some of the representatives' manufacturers in the industries. We have recently had opportunities to give the taper pressed-fit several trials in places where the cylindrical pressed-fit has caused annoyances of one kind or another, and the results have been so gratifying as to warrant an extension of the taper pressed-fit practice.

It will probably take a long time to overcome the inertia of present straight tight-fit practice, with respect to permanently set studs, just as it has taken our British friends many years to outgrow the practice of making straight steam-tight joints in pipe. When the time does come, when the straight tight screw-thread fit has been superseded by the taper tight-fit, we shall wonder why straight screw threads are ever made use of to make tight joints.

Elwood Burdsall, treasurer of the Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y., informs us that it is that company's practice to make the tap ends of studs about 0.005 in. larger than the nut ends, which are standard. The exact measurements are given in Table I.

TABLE I—PITCH DIAMETER OF TAP ENDS

Diameter Inch	Threads Per Inch	Pitch Diameter of Studs on Tap End
7/16	14	0.3961
1/2	13	0.4551
9/16	11	0.5731
3/4	10	0.6895
7/8	9	0.8085
1	8	0.9215

Pipe Dreams of a Tramp Machinist—A Summer Sabbath-Day Idyll

By Glenn Quharity

The funniest thing that ever happened at the Brookdell shop didn't happen at the shop at all but at the Methodist church just around the corner, where the "Old Man" and Tom and Pop and Bill and George and all the rest of us went to "meetin'" on Sundays. I don't know how I am ever going to get the story into the *American Machinist* unless the Editor will consider that the necessary "shop atmosphere" is furnished by the fact that George—the hero-villain—was our senior apprentice, and that the choir-master who came to his "rescue," was Pop Sawyer who made patterns and built partitions and put up countershafts at the shop for the six other days of the week.

George was in his third year at the shop and was quite an accomplished young man in some ways. He was an excellent workman, and was well liked by everybody because of his genial disposition. He was somewhat quick tempered and prone to make "cursory" remarks when things went wrong, but he couldn't even get mad without raising a laugh. He was a general favorite with the younger set about our little town where everybody knew everybody else; was prominent in their social activities and held positions of social responsibility.

All of us boys used to go to church regular—five or six times a year, generally in the fall and winter before Christmas—but George went every Sunday because he "blew" the organ.

The organ at the Methodist church occupied an alcove built especially for it so that the organ front was flush with the back wall of the building. The instrument itself did not quite fill the alcove, but left a small space about four feet wide on each side, and to cover the space from the gaze of the congregation, the panelling, which formed most of the organ front, was carried clear across the alcove, thus inclosing a small room at each side.

Concealed doors in the panelling gave access to the rooms from the auditorium. In one of these rooms the sheep of the choir used to hang their outer wraps and overshoes, while the other served the same purpose for the goats.

In the men's room the handle of the bellows protruded from the side of the organ, nearly bisecting the narrow space, making it necessary to step over or duck under in going to the window at the back of the room. The doors of these rooms opened outward on to a narrow platform at each side of the pulpit from which broad, curved steps descended to the floor of the auditorium.

To provide access to the blower room without going out on the platform in full view of the congregation a trap door was cut in the floor and a short flight of steps—half ladder, half stairway—led to the cellar. The small door opening into the auditorium was normally held shut by a concealed finger latch and was apparently a part of the organ front.

One of George's failings was a fondness for the bright yellow lights of the neighboring city (white light would not be correct for electric lighting was not then common and the aforesaid lights were gas) and he used to hit the high spots for town about every Saturday night; coming home on the late train when he didn't miss it, or walking the seven or eight miles when he did. The kitchen door of the parental domicile was always on the latch for George and the old folks never knew when he got in, for they, of course, were the last to suspect the full import of his Saturday night trips.

On one such Saturday night in early June when George returned from his usual city jambouree (during which he had not only looked upon the *pousse-cafe* when it was red, white, and blue, but had promptly put down the temptation and ordered another) there was a strange rosy glow in the eastern sky which indicated either an exalted condition of George's mind or the approach of dawn—probably the latter.

George got in all right, and tumbled into bed, but before he was fairly asleep (or so it seemed to him) he was awakened by his mother calling him to breakfast. Reluctantly he crawled out and dressed, for though he was very sleepy he was never consciously derelict in duty, and after sousing his head in a basin of cold water he felt better and prepared himself for his usual Sunday avocation in a fairly cheerful frame of mind.

Arriving at the church in due time, George promptly secreted himself in the blower room and dutifully pumped wind into the organ for the prelude, the

anthem, the offertory and all the other musical diversions that attend the opening of an orthodox service; and then when the minister got busy, George sat down in the chair which was the only piece of furniture in the room, tipped back against the panel door and elevated his feet onto the handle of the bellows.

George hadn't the slightest idea of going to sleep during the sermon; oh no! However, the warmth of the morning, the lack of sleep the night before, and the droning voice of the minister indistinctly heard through the organ, was a combination too strong for healthy human nature, and George was presently fast asleep with the uptilted front legs of his chair directly over the edge of the trap that led to the cellar.

The minister finished his sermon and the choir made ready to sing the closing ode. The organist slid onto

the polished bench before her keyboard, pulled out the proper stops and proceeded to draw the sweet introductory strains from the soul of the organ.

But there was a hitch somewhere. Though she was going through all the motions in their proper order the strains wouldn't draw. She jiggled frantically at the dummy stop that connected with the rattle box in the blower room to indicate to George the need for wind, but there was nothing doing—nothing a *tall;* there simply was no wind in sight; not even a breeze. The choirmaster had sensed the true inwardness of the difficulty at the first symptom; he knew George. He slipped unobtrusively off the other end of the platform and quietly disappeared through a door leading to the parlor.

The congregation had just commenced to realize that something not on the program was happening when the choirmaster reached the steps leading to the blower room and slammed open the trapdoor. The edge of the trap struck squarely under the front legs of George's chair and the latch holding the panel door, already under a heavy responsibility, gave way.

The door flew open and a dishevelled young Indian accompanied by a war-whoop and followed by the remains of a chair, catapulted in a back somersault down the pulpit steps and onto the floor of the auditorium before a horrified congregation.

It was an awful moment!

Piecework in German Shops

By C. A. Heise

One of the first things following the German revolution was the abolishment of piecework in most of the factories by the workers' councils. However, on account of the apprehension caused in industrial quarters by the threatening break-up of the entire German economic system, the German Federal Board of Work has consulted the Berlin Chamber of Commerce with a view of giving expert advice as to the relative merits of the existing wage systems. The report of the chamber has just been published and makes rather interesting reading inasmuch as it recommends the re-introduction of piecework. In the course of the statement it is pointed out that from an economic point of view ordinary wages have proved an utter failure. Accordingly, the chamber has come to the conclusion that a sound and social wage system can only be based on the principles of fair piecework payment. The workers themselves as well as the unions are beginning to realize that the re-introduction of piecework was of utmost importance in trying to regain Germany's lost markets. The faults and defects of the piecework system formerly in use were freely admitted; on the other hand, it was shown that with the introduction of the eight-hour day the time-honored argument of piecework undermining the health of the workers has now lost most, if not all, of its former force.

In order to insure a fair administration of the piecework system the chamber suggests that all piecework rates should be fixed previously to the man starting on the job and the man be informed as to the rate. Furthermore, the fixing of the rates at the larger works should no longer be done by the foremen but by experienced time-rate fixers trained for the task in special classes held in industrial schools, and no cutting-down of rates so fixed and agreed upon should be permitted.

It was also recommended that workers engaged on so-called non-productive work, including clerks, etc., should be paid by a system representing a combination of ordinary time work and bonus work. It is highly interesting to note that the chamber, on account of the present German economic situation, considers the demand of the workers for profit sharing on a large scale unwarranted, it being held that no profits could be distributed at all, or only on so small a scale as not to figure as a stimulating factor.

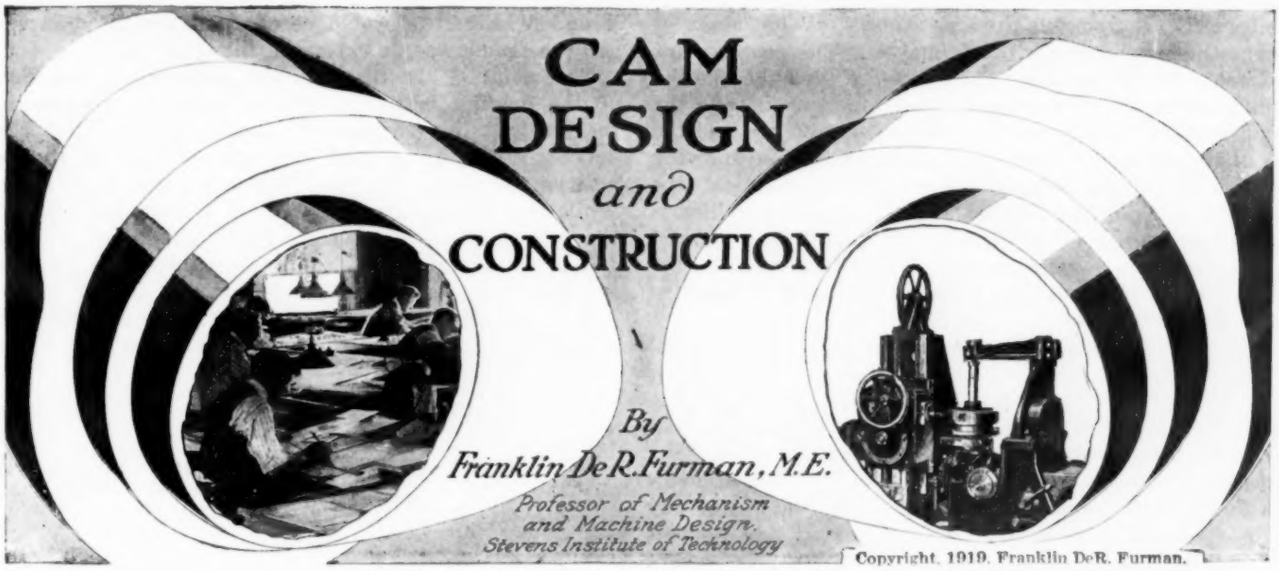
A Sample Board for the Tool Dresser

By K. Saldiz

I stumbled across a little kink in tool dressing the other day that I had not seen elsewhere, that is a real time and money saver wherever a blacksmith is kept busy all day dressing tools.

Every kind of cutting tool used on lathe, shaper, planer, boring mill, etc., is made up of wood, nailed on a board, and kept near the tool fire. This is a good way to stop quarrels and misunderstandings between the machinist and the tool dresser and eliminates waste of time resulting from the machinist (war brand) not knowing the proper name of the tool he wants or the tool dresser not being able to understand the description.

Now, if a machinist comes along and wants a tool bent to the right with the cutting edge on the point (offset parting tool), the tool dresser simply points to the board and lets him pick out the shape he wants.



X. Variable Angular Velocity in the Driving Cam Shaft

The subjects considered in the current issue are: Variable angular velocity in the driving shaft as applied to the toe and wiper cam, the determination of the amount of rubbing or sliding action in cam mechanisms where the follower surface is flat or curved instead of being a roller or a V edge, and the principles on which all sliding friction may be eliminated between cam and follower surfaces with their applications to logarithmic and computed cam curves.

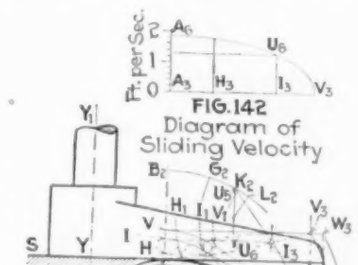
(Part IX was published on page 739.)

THE subject of variable angular velocity in the drive shaft of a cam applies to all types of cams, but it is rarely met with except in oscillating cams. The reason for this is that in machinery in general the shafts that make a full turn do so with practically uniangular velocity except in slow-advance and quick-return motions and in some special cases, and therefore the shaft that operates a cam in general is considered to have uniform angular velocity. But with the oscillating cam the motion must come through a crank and connecting-rod, or eccentric and beam, or some other device, from a shaft which in general turns with unifom angular velocity and which gives to the oscillating cam a variable angular velocity, as illustrated in Fig. 137, where the unequal arcs B_1G_1, G_1K_1 and K_1L_1 represent the distances traversed by the cam pin B_1 while the main-shaft crankpin turns through the equal arcs BG, GK and KL. The method of building a cam which has variable angular velocity will be illustrated in the following problem:

PROBLEM 24.—OSCILLATING CAM HAVING VARIABLE ANGULAR VELOCITY, TOE AND WIPER TYPE.—Required an oscillating wiper cam operated by a crank and connecting-rod from a main shaft to raise and lower a straight-toe follower through a distance of one unit while the crankshaft turns through 120 deg. Assume the following dimensions: Main crank radius CB, 4 units, Fig. 137; connecting rod length BB_1, 20 units; cam arm radius B_1O, 5 units; shortest cam surface radius OA, 2 units.

Find the distance the follower will move during each of three equal periods of time on the up stroke.

The first step in the solution of the problem is to lay out the main crank center as at C in Fig. 137; then the crankpin circle with a radius CB of 4 units, and next the connecting-rod length of 20 units on the center line, as at EJ. Lay off the assigned 120 deg. of crankshaft motion symmetrically about the main center line, as at BCD, and with B and D as centers and the length of the connecting-rod as a radius draw two arcs intersecting on the horizontal center line, thus locating B_1. With C as a center and the connecting-rod plus the crank as a radius draw the arc passing through J; with C as a center and the connecting-rod minus the crank as a radius draw the arc passing through J_1. To find the center O of the camshaft, Fig. 137, take B_1 as a center and the assigned cam-arm radius of 5 units and draw an arc on which the point O will be found later. On this arc find a point by trial and error with the compass which is the center of an arc which passes through B_1 and which



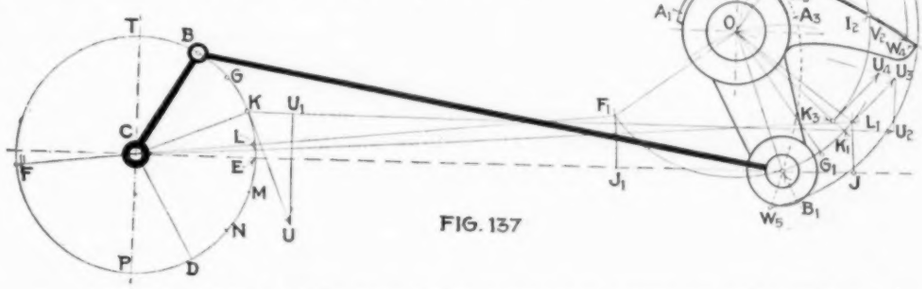


FIG. 137. OSCILLATING CAM WITH VARIABLE ANGULAR VELOCITY

intersects the two arcs through J and J_1 at the same elevation, as, for example, at L_1 and F_1. The center point so found is the point O. The arc $L_1B_1F_1$ will then be the arc of swing for the center of the cam-arm pin, and the angularity of action between the connecting rod and the cam arm at the two extreme ends of the cam-arm swing will be approximately the same. Draw a vertical line through O and mark the assigned distance OA, which is the shortest radius of the cam surface. The horizontal line through A will be the lowest position of the flat-surface follower toe. The distance AV is equal to the assigned motion for the follower.

Having completed the general layout of the assigned data the cam surface AV_2 is found as follows: Draw the arc B_2L_2 with a radius equal to OB_1 and make the length B_2L_2 equal to B_1L_1. Revolve V about O until it meets the radial line drawn form L_2 to O, thus determining the point V_1. At this latter point draw a line V_1V_2 perpendicular to OV_1. With the aid of any smooth-edged curved ruler draw a curved line tangent to AW at A and also tangent to V_1V_2 at the point where it happens to come. Such a curved line is shown at AV_2 in Fig. 137. Any other curved line tangent to the straight lines AW and V_1V_2 would have done the work in the same time, but would have given slightly different intermediate velocities to the follower as will be explained in a later paragraph.

The actual working length of the follower toe is readily obtained by revolving the point of tangency V_2 about O until it meets the horizontal line through V at V_3. Projecting V_3 down to AW and adding a short distance WW_1 to prevent a sharp-edge action, the practical length AW_1 is obtained. If the toe shaft is offset a distance AY, the total length of the follower toe will be YW_1.

To Find the Distances Moved by the Follower Toe during each of three equal periods while on the upstroke divide BL, Fig. 137, into three equal parts as at G and K. With these points as centers and with the connecting-rod length as a radius, construct short arcs intersecting B_1L_1 as shown at G_1 and K_1. Lay off the arcs B_1G_1 and B_1K_1 at B_2G_2 and B_2K_2, and draw the radial lines OG_2 and OK_2. Perpendicular to these radial lines draw other straight lines tangent to the curved cam surface AV_2, thus obtaining the lines H_1H_2 and I_1I_2. Revolving H_1 and I_1 back to the vertical line, the points H and I will be obtained and the distances moved by the follower during the three equal time periods on the up stroke will be AH, HI and IV respectively.

The Path of Contact Between the Cam Wiper and the Toe is shown by the curved dash line AV_2, Fig. 137. Points on this curve, such as at I_2, are obtained by revolving the point of tangency I_1 around until it meets the horizontal line through I.

In problems of this kind (problem 24) the follower toe takes a longer time for the down stroke than for the up stroke as shown by the length of arc LD as compared with LB, Fig. 137. This could be rectified and both times made the same, if desired, by placing the center O of the cam so that the points B_1 and L_1 would be on the horizontal line through C. This would only be possible with certain limited combinations of lengths of crank arms and rods, and in any event the intermediate velocities of the follower would be different on the up and down strokes. If it were desired to know the distances moved by the follower during three equal periods on the down stroke the equally spaced points M and N, Fig. 137, would be obtained and used in exactly the same way as explained for G and K.

The point F is the outward dead-center position of the driving crankpin and is found by continuing the straight line through F_1 and C to F. When the driving crankpin is at F the cam surface is in the position shown by the dash line A_2W_2 and A_1 is at A. While B is moving from D to F, A_1 is moving to A and the follower toe is at rest, being supported by the cylindrical surface, AA_1, rubbing against it; or it may be supported by a resting block indicated at SA.

It is sometimes thought that this toe-and-wiper cam is practically free from rubbing action, especially where

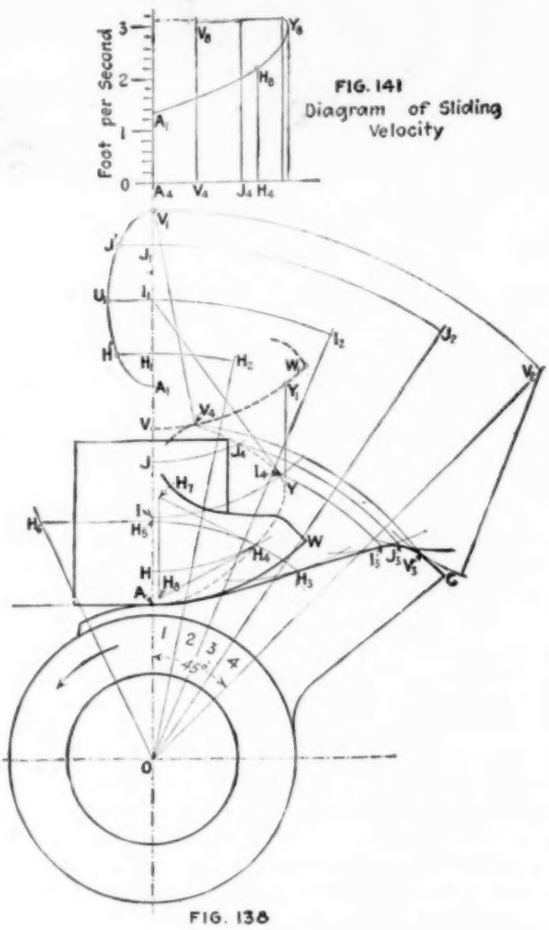


FIG. 138. OSCILLATING CAM WITH CURVED TOE FOLLOWER

the length of the toe surface equals approximately that of the wiper, but it will be seen from the velocity diagram shown just above the cam and described in later paragraphs, there may be considerable rubbing. There must be some sliding in all flat-toe followers where the acting surface is perpendicular to the right line motion of the follower, as it is in Fig. 137.

Toe and Wiper Cam Where Toe Is Curved—In the toe and wiper cam explained in the paragraphs immediately preceding, a flat surface toe YW, Fig. 137, was used. A curved toe, such as is shown at AW, Fig. 138, may be used as illustrated in the following problem:

Problem 25. Required a Wiper Cam to Operate a Curve-Toe Follower which shall move: (a) Up four units on the elliptical base curve where the ratio of axes is 2 to 4 while the cam turns 45 deg. in a counter-

clockwise direction with uniform angular velocity; (b) down four units on the same base curve while the cam turns 45 deg. in a clockwise direction with uniform angular velocity. While the follower toe may have the form of any smooth curve which is convex to the cam wiper, an arc of a circle will be assumed because of the ease in drawing. The shortest radius OA of the wiper cam, Fig. 138, is assumed. The form of the curved toe is the circular arc AW, with its center at A_1. It is convenient in such a problem as this to work with the center points of the follower arc, and therefore the

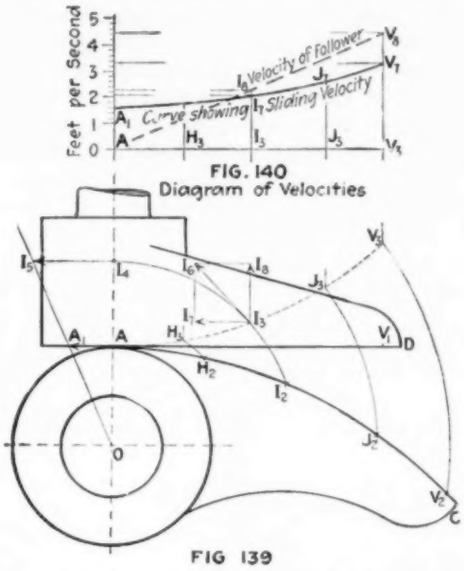


FIG. 139. SLIDING IN TOE AND WIPER CAMS

four units of travel are laid off first at A_1V_1 instead of AV. The semiellipse in which $I_1U_1 : I_1V_1 :: 2 : 4$ is drawn and the perimeter divided into equal parts at $J'U_1H'$. Only four construction points are used in this problem in order to secure as much simplicity as possible in the illustration. In practice more construction points should be used. The four construction centers at H_1, I_1, J_1, V_1 are revolved to their corresponding positions relatively to the cam at H_2, I_2, J_2, and V_2, and the toe arcs drawn as shown at H_2, I_2, J_2 and V_2. The wiper-cam curve AC is then drawn tangent to these arcs and the tangent points revolved back to their actual positions at H_2, I_2, J_2, and V_2, thus obtaining the locus of contact between the wiper and toe. This locus is shown by the dash-line curve AH_2V_2. The necessary length VY_1 of the follower arc is also obtained by projecting the extreme point Y on the locus to Y_1 and adding an abitrary distance such as Y_1W_1 to avoid wear at the tip end.

IF AN IRREGULAR CURVE HAD BEEN USED for the form of the toe instead of a circular arc it would have been necessary to construct a templet of the desired form of the toe and to move it out radially the desired distances on each of the radial construction lines, keeping the templet always in the same relative position with each of the radial lines. At each of the four adjustments of the templet, arcs would have been drawn against the templet edge and the work then continued as described in the preceding paragraph.

The pressure angles in the toe and wiper cams are quite different for flat and curved toes. In Fig. 137 the line of pressure is always parallel to the axis YY_1 of the follower rod as illustrated by the vertical line at WV_2, and the maximum leverage with which it acts on the bearings is YW. With the curved-toe wiper the line of pressure is an inclined line and the pressure angle at the top of the stroke is $V\,V_1V_2$, Fig. 138, and when the follower is half way up the pressure angle is $I\,I_1I_2$.

RATE OF SLIDING OF CAMS ON FOLLOWER SURFACE—The rubbing velocity of cams which are in sliding contact with the follower may be readily determined by constructing simple velocity diagrams at each of the construction points, as explained in the following paragraphs:

PROBLEM 26. RATE OF SLIDING BETWEEN CAM AND FLAT FOLLOWER SURFACE—Find the curve of rubbing velocity between surfaces in a toe and wiper cam mechanism where the follower toe is a flat surface. Assume that the wiper oscillates with uniform angular velocity.

In Fig. 139 let the angle I_1OI_2 represent the uniform angular velocity of the wiper cam. Then the point I_1 on the cam will have the linear velocity I_1I_2. Laying this value off at I_2I_2, where I comes into action, and taking the component I_2i_2, the actual rubbing velocity is obtained. This may be transferred to I_2I_1 in Fig. 140, and finding other ordinates the complete sliding-velocity curve A_1V_1 is obtained. The ordinate $A\,A_1$ is quickly obtained for it is obviously equal to the linear velocity line $A\,A_1$ in Fig. 139. In Fig. 139 the detail construction for obtaining the velocity of the follower is shown only at one point I_2, the construction at the other points being the same.

THE ACTUAL RATE OF SLIDING IN FEET PER SECOND may be readily found at any position by means of the velocity diagram in Fig. 140. For example, if the camshaft O, Fig. 139, is considered to oscillate back and forth through 45 deg. 100 times per minute with uniform angular velocity, and if the radius $O\,I_1$ is 14 in., the line I_1I_2 will represent a velocity of

$$\frac{2 \times 14 \times 3.14 \times 2 \times 100}{8 \times 12 \times 60}$$

= 3.05 ft. per second. This value, laid off as the resultant velocity at I_2 gives a component or sliding velocity I_2I_1, which is laid off at I_2I_1 in Fig. 140. The minimum rate of sliding will be $A\,A_1$, shown in both Figs. 139 and 140, and will be 1.6 measured on the same scale that was used to lay out I_1I_2.

THE VELOCITY OF THE FOLLOWER IN FEET PER SECOND may also be readily found by simply taking the vertical component I_2i_2, Fig. 139, and laying it off at I_2I_2 in Fig. 140. Taking the vertical components at other points the line $A\,V_2$, showing the linear velocity of the following, will be obtained. The line $A\,V_2$ is a straight line in this problem because this cam illustration was taken so that the follower would have uniformly increasing velocity. In general, where the cam curve $A\,V_2$ in Fig. 139 is assumed, the line $A\,V_2$ in Fig. 140 will not be straight.

PROBLEM 27. SLIDING VELOCITY WITH CURVE-TOE FOLLOWER—Find the curve of rubbing velocity between surfaces in a curved toe and wiper cam mechanism, assuming that the wiper oscillates with uniform angular velocity. In curved-toe followers the general principle of obtaining the rubbing velocity is the same, although the detail of drawing the velocity diagram differs slightly. In Fig. 138 the linear velocity of the point H_2 on the cam is H_2H_2, and this value is laid off at H_1H_1. The direction of sliding at this phase must be that of the common tangent line to the two surfaces.

and its length, which represent the velocity of sliding, is found by drawing the line H_1H_4 parallel to the direction of motion of the point H_4 on the follower. The length of H_1H_4 is thus found and is laid out, as shown in Fig. 141, directly over H_4 of Fig. 138. Other lines representing the rubbing velocity are similarly found and laid out in Fig. 141, thus obtaining the rubbing velocity curve $A_1H_4V_4$.

In the case of the curved-toe follower it will be noticed that that portion of the toe from V_4 to Y_4, Fig. 138, will be traversed twice as often as the portion from V to V_4, and in addition the rubbing velocity will be much greater. In the flat-toe follower, Fig. 139, the point of contact travels regularly forth and back the full distance on each stroke, but the wear as in the curved-toe follower will be irregular, due to the variable rubbing velocity, which in the case illustrated in Fig. 140 is a maximum at the tip end.

PROBLEM 28. SLIDING VELOCITY WHERE CAM HAS VARIABLE ANGULAR VELOCITY—Find the curve of rubbing velocity between surfaces in a flat-toe and wiper-cam construction, assuming that the wiper cam oscillates with a variable angular velocity.

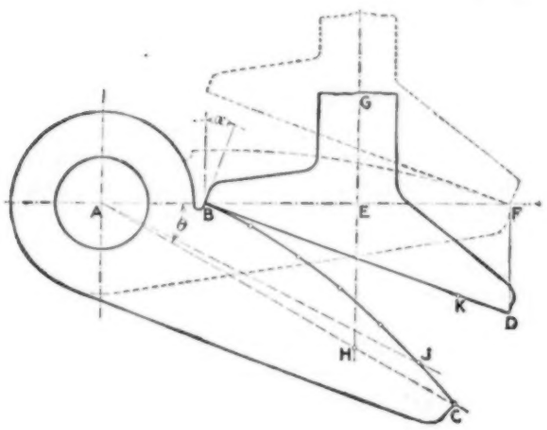


FIG. 143. OSCILLATING CAM WITH PURE ROLLING ACTION ON STRAIGHT-EDGE FOLLOWER

When an oscillating cam has variable angular velocity, as in Fig. 137, the extent of the sliding action between cam and follower may be found as in the following example. In Fig. 137 the length of crank represented by CE is 4 in. and the crank is assumed to be turning at 120 r.p.m. The velocity of the crank pin will be

$$\frac{2 \times 3.14 \times 4 \times 120}{12 \times 60} = 4.19 \text{ ft. per second.}$$

This velocity is represented by the line KU, Fig. 137, laid off to some convenient scale. Its component KU_1 along the connecting rod is found by dropping from U a perpendicular to the connecting-rod position KK_1.

The component KU_1 is then transferred to the other end of the rod at K_1U_1. This component gives a resultant linear velocity of K_1U_2 to the cam crankpin at the phase K_1. At the radial distance OK_2, which is equal to the radii OI_4 and OI_2, the linear velocity will be K_2U_2 and this transferred to I_4 will give I_4U_4 as the resultant linear velocity of I_2 when it becomes the driving point. The line I_4U_4 is the component in the direction in which sliding must take place, and this is laid off at I_4U_4 in Fig. 142. If KU represents 4.19 ft. per second, I_4U_4 will represent 1.30 ft. per second to the same scale, and the maximum velocity of sliding, which is represented at A_2A_4, will be 1.87 ft. per second.

ELIMINATION OF SLIDING FRICTION WHERE FLAT OR CURVED SURFACE FOLLOWERS ARE USED.—The ordinary toe and wiper cam mechanism operates with more or less sliding action, as shown in the preceding paragraphs. Cams resembling the toe and wiper type may be constructed so as to eliminate all sliding friction by using special curves and lines for the wiper and toe surfaces, as will be explained in succeeding paragraphs. Fig. 143 shows a straight surface toe moving up and down in a straight line, while in Fig. 150 a similarly moving toe has a curved working surface. In both there is pure rolling action. Likewise in Figs. 146 and 149 the working surface of the follower arm is straight in one case and curved in the other, yet in both cases there is pure rolling action. In all cases of pure rolling action on flat or curved surfaces it is impossible to assign various intermediate velocities to the follower as part of the data of the problem.

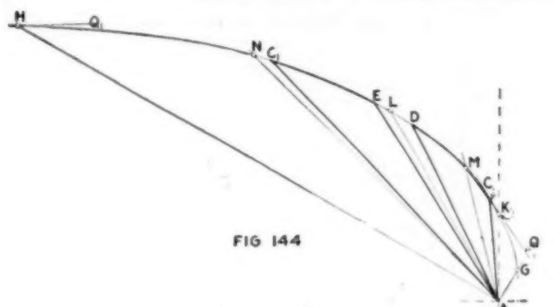


FIG 144

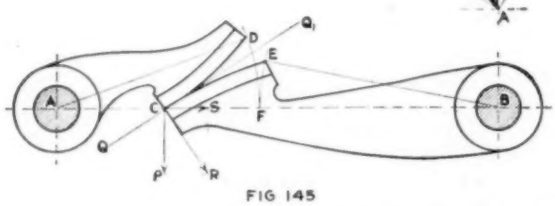


FIG 145

FIG. 144. BASIC LOGARITHMIC CURVE FOR OSCILLATING CAM ARMS HAVING PURE ROLLING ACTION. FIG. 145. SWINGING CAM ARMS WITH LOGARITHMIC SURFACES IN PURE ROLLING ACTION

THE PRINCIPLE OF PURE ROLLING ACTION BETWEEN CAM SURFACES.—It is a fundamental principle of pure rolling action between two rotating surfaces that the point of contact between them must always be on the line of centers. This is illustrated in Fig. 145, where the point of contact C is on the line of centers $A\,B$ and where the contact point between the curves $C\,D$ and $C\,E$ will always be on the line of centers. This principle also applies in Fig. 143 where the follower toe $B\,D$ is moving up and down in a straight line and where it must be considered that the toe is turning about a point on the line $A\,B\,F$ at an infinite distance. Then $A\,F$ becomes the line of centers and the point of contact between $B\,C$ and $B\,D$ will always be on the line $B\,F$.

WELL-KNOWN CURVES THAT LEND THEMSELVES READILY TO PURE ROLLING ACTION IN CAM WORK are the logarithmic spiral and the ellipse. Examples of these will be given in following paragraphs where the solutions are entirely graphical and comparatively simple. The parabola and the hyperbola may also be readily used for rolling cam surfaces. Any line or curve that may readily be expressed by a mathematical equation may also be taken as one surface and the equation for the other curve that will work with it in pure roll-

ing action may be derived. An example of this is given in a later paragraph. The use of the logarithmic curve for pure rolling action in the toe and wiper type of construction where the follower toe has a straight-edge working surface and moves in a straight line is given in the paragraphs immediately following.

PROBLEM 29. PURE ROLLING WITH FLAT SURFACE FOLLOWER.—Required an oscillating logarithmic cam arm that will give a straight line reciprocating motion to a flat-surface follower arm with pure rolling action: (a) The follower to move up 4½ units, while the cam turns 30 deg.; (b) the pressure angle to be 20 deg.

This problem is illustrated in Fig. 143, where the flat surface toe *B D* is moved from the solid-line position to the dash-line position while the cam *A B C* swings through the angle *C A F*. The method of constructing the problem is as follows:

Draw the horizontal line *A F*, Fig. 143, and from any point *B* draw a line *B D*, making an angle with *B F* equal to the assigned pressure angle. Continue *B D* until the vertical distance between it and *B F* is equal to the assigned lift of the follower, 4½ units in this problem as measured at *D F*. Mark the point *F*. Assume the distance *A B* sufficient to allow for the camshaft and cam hub. *A B* is taken as four units in this problem, and *A F* is found upon measuring to be 16 units. Substitute these values in the following general equation:

$$\theta = \frac{180^\circ \times \tan \alpha}{\pi \times .434} \log \frac{R}{r}$$

in which $r = 4$, $R = 16$, $\alpha = 20$ deg. and in which θ gives the angle whose limiting radial line *A C* is equal in length to *AF;*

$$\theta = \frac{180^\circ \times .364}{3.14 \times .434} \times .602 = 28.8^\circ$$

The angle of 28.8 deg. is then laid off at *FAC*, as shown in Fig. 143, by means of a protractor. If a protractor is not at hand this angle may be readily constructed with the aid of a trigonometrical table from which the tangent of 28.8 deg. is found to be 0.55. Lay off *A E* equal to one unit on any independent scale and draw a perpendicular line *EH* at *E*. On this line lay off 0.55 of this unit, thus obtaining the point *H*. The angle *E A H* will then be 28.8 deg. Draw *A H* and continue it to *A C*, making *A C* = *A F* = 16 units on the scale of the cam drawing. The logarithmic curve through *B* and *C* will be the one which will work in pure rolling action with the straight line *B D*.

To obtain other points on the curve *B C* as at *J*, assume intermediate values for *R* in the above formula, *r* remaining the same as before. Taking *R* at 14 units and again solving the equation, θ is found to be 26 deg., and this angle is laid off at *E A J*. *A J* is made 14 units in length. In like manner other points shown by dots between *J* and *B* may be found by taking *R* equal to 12, 10, 8 and 6 in successive computations and laying off the resulting angles, which are found to be 22.9 deg., 19.1 deg., 14.4 deg. and 8.45 deg., respectively.

The pressure angle between the two cam surfaces will be a constant and equal to α. The smaller the pressure angle the longer will be the toe of the follower for a given lift. As a corollary to the conditions of pure rolling action it follows that the developed length of the logarithmic arc *B C* must be equal to the length of the straight line *B D*. The stem *E G* of the follower toe may in general be taken with its center line midway between *B* and *F*.

PURE ROLLING BETWEEN TWO OSCILLATING CAM ARMS—The use of the logarithmic curve for pure rolling action between two rolling cam arms, where both arms oscillate, is shown in the paragraphs immediately following. Before taking up a definite problem it is necessary to consider, in order to obtain a satisfactory understanding, some of the properties peculiar to the logarithmic curve. These properties are:

First, that in a series of equally spaced radial lines drawn from the pole to the logarithmic curve the length of any one line is a mean proportional of the lines on either side. To illustrate, the curve *G H*, Fig. 144, is a logarithmic curve, the radial lines *A G*, *A K*, *A L* and *A H* are spaced by equal angles and *A K* : *A L* :: *A L* : *AH*, or, $AL = \sqrt{AK \times AH}$. The spacing angle may be of any size.

Second, that the difference in length between any two radial lines drawn from the pole to the curve will be the same no matter where those radial lines are taken, providing they intercept equal lengths of arc. To illustrate, the difference $C_1A - EA$, Fig. 144, is equal to *D A* — *C A* for the reason that the arcs *E* C_1 and *C D* were made equal in developed length.

Third, that a tangent and a radial line at any point on a logarithmic curve form the same size of angle, no matter where the point is taken. To illustrate, the angle between the tangent *Q C* and the radial line *A C*, Fig. 144, equals the angle between Q_1H and *A H*.

PROBLEM 30. PURE ROLLING WITH LOGARITHMIC CURVED CAM ARMS—Construct a pair of pure rolling oscillating cam arms with logarithmic curved surfaces, the driver swinging through 21 deg. and the follower arm through one-half of that angle.

The first step in the solution of problem 30 consists in drawing a logarithmic curve of any desired curvature by assuming any convenient angle such as 60 deg., as shown at *K A H* in Fig. 144, and any two lengths of lines as shown at *A K* and *A H*. *K* and *H* will then be points on the logarithmic curve. To find an intermediate point, bisect the angle *K A H*, as at *A L*, and make *A L* a mean proportional between *A K* and *A H* in accordance with the first general principle mentioned above. To find a point to the right of *K* make the angle *K A G* equal to angle *L A K;* then *A K* becomes the mean proportional and *A G* : *A K* :: *A K* : *A L*, or $AG = \frac{AK^2}{AL}$.

Having constructed the general logarithmic curve as above, lay off an angle of 21 deg. with the vertex at *A*, Fig. 144, and with the sides at *A C* and *A D*, or the sides may be in any other position, according to the length desired for the cam arms. Make a tracing of the angle *C A D* and of the arc *C D* and reproduce it at *C A D* in Fig. 145. Also draw the body outlines of the cam arm, and the driver is then completed. To find the follower, step off the arc *C D*, Fig. 144, into four or six steps with the dividers, and restep the distance *C D* off on another part of the logarithmic curve where the newly placed arc, equal to *C D*, will be subtended by an angle of 10½ deg. as specified in the data. The new position for the length of the arc must be found by trial, and in this problem it is at *E* C_1 in Fig. 144, where the arc *E* C_1 equals *C D* in length and the angle *E A* C_1 equals one-half of *C A D*. The angle *E A* C_1 and the arc *E* C_1 are now traced on tracing cloth and redrawn at *C B E* in Fig. 145. Upon drawing the outlines for the arm the follower is completed.

THE ANGULAR MOTION OF EACH CAM depends on the positions on the logarithmic curve at which the equal arcs are taken. Had it been desired to swing the shaft B through a larger angle the logarithmic arc $E C_1$, Fig. 144, would have been taken lower down. When $E C_1$ coincides in position with $C D$, the arm $C B$, Fig. 145, will swing through the same angle as the arm $C A$, and both arms will be of the same length and identical in every way.

TANGENCY OF LOGARITHMIC CAM SURFACES—The fact that the two rolling cam curves $C D$ and $C E$, Fig.

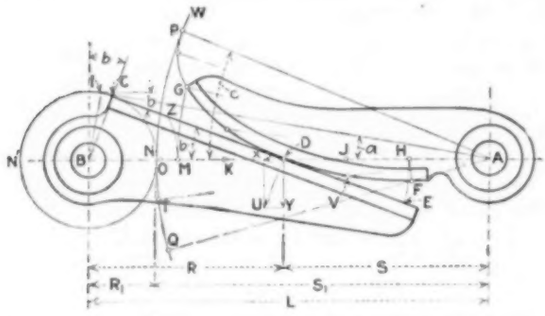


FIG. 146. SWINGING CAM ARMS WITH DERIVED SURFACES IN PURE ROLLING ACTION

145, are tangent at C follows from the third principle laid down in a preceding paragraph which points out that the tangents at C and C_1, Fig. 144, make the same angles with $C A$ and $C_1 A$ respectively. Since C and C_1 come together on the same straight line $A B$, in Fig. 145, the angle $B C Q_1$ in the figure will equal the angle $A C Q$.

REGULATION OF PRESSURE ANGLE WHERE LOGARITHMIC ROLLING CAMS ARE USED—Logarithmic curves of varying sizes, or expansion, may be used for rolling cam surfaces, but in general the best results will be obtained by using curves having a large expansion. The expansion may be measured specifically by noting the

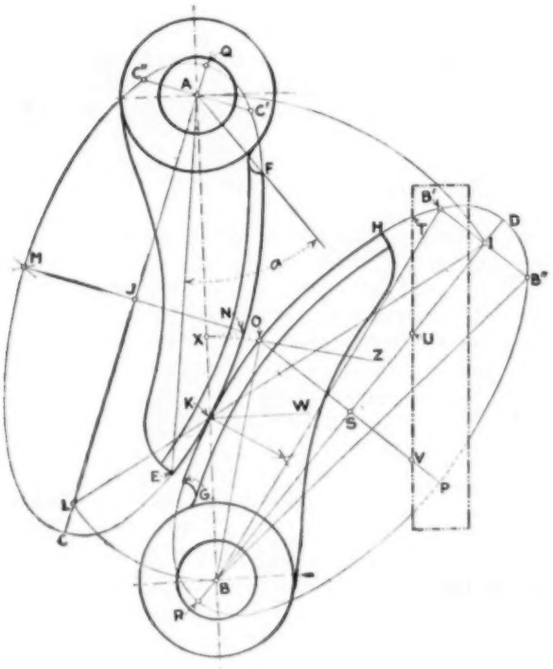


FIG. 147. BASIC ELLIPSES FOR PURE ROLLING CAM ARMS

rate of increase in the length of the successive radial lines which are drawn at equal angles with each other. The greater the expansion of the logarithmic curve the smaller will be the pressure angle, or radial pressure, on the bearings of the cam. This is shown in Fig. 145 where $P C R$ is the pressure angle and $C S$ is the radial pressure on the bearings. If curve $C D$ had a greater expansion its normal $C R$ would fall nearer $C P$ and the pressure angle would be smaller.

DERIVED CURVE FOR ROLLING CAM ARMS—Any line or curve that is expressed by a mathematical equation may be taken as the form of an oscillating cam arm, and the equation for another curve that will work with it in pure rolling action may be derived. In the paragraphs immediately following a cam arm with a straight surface is assumed and the curve that will work with it is derived. The derivation of the curve involves the use of calculus, but the results are comparatively easy to apply practically.

PROBLEM 31. THE USE OF A DERIVED CURVE FOR ROLLING CAMS—Given a straight-edge oscillating follower arm. Required a curved oscillating arm that will work with it in pure rolling action.

In solving the above problem the following notation illustrated in Fig. 146 will be used:

a = angle between the line of centers of the oscillating arms and the line of the straight follower surface for the phase in which this line, when extended, passes through the axis of the driver shaft. The angle a is a constant.

b = angle turned through by the straight follower arm, at any phase, measured from the horizontal position.

c = construction angle for the curved follower arm.

L = distance between centers.

R = working radius of follower arm at any phase.

S = working radius of driver arm at the phase corresponding to R.

Then

$$\sin a = \frac{BI}{AB} = \frac{R_1}{L} \qquad (1)$$

$$R = \frac{BC}{\sin BDC} = \frac{R_1}{\sin b} \qquad (2)$$

$$S = L - R \qquad (3)$$

$$c = \frac{180^\circ \tan a}{\pi \times 0.4343} \log \frac{\cos \frac{1}{2}(b + a)}{\sin \frac{1}{2}(b - a)} \qquad (4)$$

Assuming $L = 24$ and $R_1 = 4$ we have from equation (1) $\sin a = \frac{4}{24} = 0.1668$, and from a table of sines $a = 9\frac{3}{4}^\circ$.

Then from equations (2) and (3)

For $b = 12^\circ$, $R = \frac{4}{.208} = 19.22$ and $S = 24 - 19.22 = 4.78$

$b = 15^\circ$, $R = \frac{4}{.2588} = 15.45$ and $S = 24 - 15.45 = 8.55$

$b = 20^\circ$, $R = \frac{4}{3.42} = 11.70$ and $S = 24 - 11.70 = 12.30$

Similarly for $b = 30^\circ$, $R = 8.00$; for $b = 50^\circ$, $R = 5.23$; for $b = 70^\circ$, $R = 4.26$; and $b = 90^\circ$, $R = 4 = R_1$.

From equation (4)

For $b = 12^\circ$, $c = \frac{180^\circ \times .1718}{3.1416 \times .4343} \log \frac{\cos \frac{1}{2}(12^\circ + 9\frac{3}{4}^\circ)}{\sin \frac{1}{2}(12^\circ - 9\frac{3}{4}^\circ)}$

$$= 22.67 \log \frac{.982}{.0196} = 22.67 \times 1.70 = 38.6°$$

$$b = 15°, c = 22.67 \log \frac{.9767}{.0457} = 22.67 \times 1.32 = 30°$$

$$b = 20°, c = 22.67 \log \frac{.9665}{.0893} = 22.67 \times 1.033 = 22.8°.$$

Similarly for $b = 30°$, $c = 16.5°$; for $b = 50°$, $c = 9.1°$; for $b = 70°$, $c = 4.2°$; and for $b = 90°$, $c = 0°$.

Plotting the above values of R in Fig. 146, $BH = 19.22$ and $AH = 4.78$; $BJ = 15.45$; and $BD = 11.70$, etc. A test of the accuracy of the work thus far may now be made by drawing a line from H tangent to the circle having R_1 for a radius and noting if it makes an angle of 12 deg. with the line of centers. Likewise a line from D tangent to this same circle should make an angle of 20 deg. with DB, etc.

Again, plot the values of c, starting with any phase in which it is desired to show the cams. In this case the phase illustrated is for the straight cam at an angle of 20 deg. Lay off the angle $DAP = 22.8$ deg. Then starting with AP as a datum line lay off the values of c as found above, making the arc $PQ = 38.6°$, arc $PT = 30$ deg., etc.

Finally on each of the lines AQ, AT, etc., lay off the corresponding values of S. These values have already been found to be 4.78, 8.55 respectively, etc. Thus the points F, V, D .... P on the follower cam curve are obtained.

ROLLING CAMS USEFUL FOR STARTING SHAFTS GRADUALLY—The curve FDP is tangent to the circular arc having AP for a radius. This suggests an interesting and perhaps useful mechanical addition in that gear teeth might be cut on GPW as a pitch line, and also on ZCN' as a pitch line, thus permitting an oscillating shaft A to give a certain number of complete revolutions in opposite directions to the shaft B. In starting each cycle the shaft B would accelerate gradually and it would come to rest gently at the end of its cycle. The rate at which the motion of the shaft B would accelerate at starting is indicated by the ratios $\frac{HA}{HB}$ to $\frac{NA}{NB}$. Giving the actual values which these ratios have in this problem it is found that the acceleration of B increases from $\frac{4.78}{19.22}$ to $\frac{20}{4}$ or from about one-fourth of the angular velocity to five times that of the shaft A.

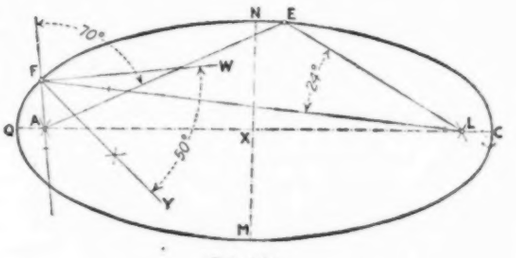


FIG. 148

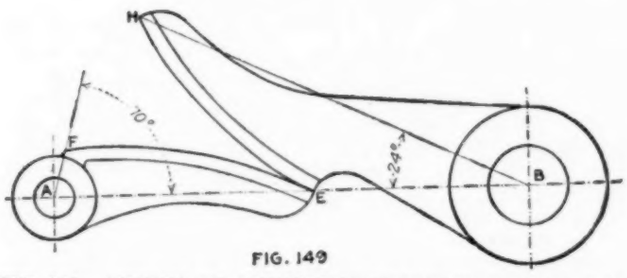


FIG. 149

FIG. 148. ANGLES OF ACTION FOR ELLIPTICAL CAM ARMS
FIG. 149. PURE ROLLING ELLIPTICAL CAM ARMS

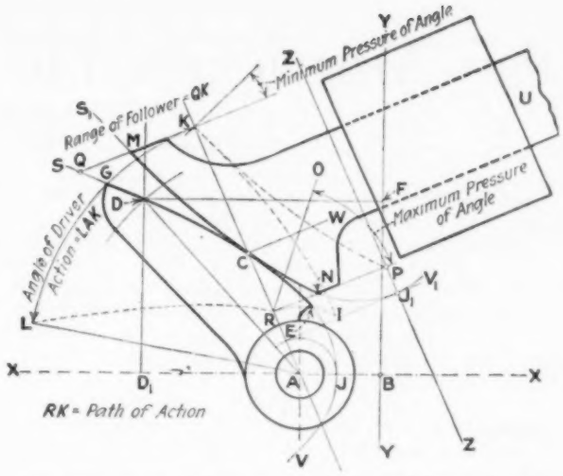


FIG. 150. PARABOLIC CAM SURFACES FOR PURE ROLLING RECIPROCATING MOTION

REGULATION OF PRESSURE ANGLE WITH DERIVED ROLLING CURVE—Returning to problem 31 and considering it only as a cam mechanism, it will be noticed that the angles taken for b in the computations become the pressure angles and show a measure of the radial thrust that goes into the bearing without producing any useful rotative effort. For example, in Fig. 146 the cams are in contact at D and the normal pressure is represented by DU. The component pressure DX goes to the bearings and DY is useful in turning the shaft B. The pressure angle UDY is 20°. When G reaches M it will be in contact with Z and the pressure angle will be 50 deg.

[Figs. 147 to 150 were printed in this issue for reference purposes only. They will be reprinted and described fully in the next installment.]

Cast-Iron Pulley Displaces Aluminum

With a view to avoiding well-known difficulties in reversing the tables of planing machines, the need for reduced mass in the case of revolving parts has been shown. To minimize the energy of the pulley it has often been made of aluminum instead of cast iron. One case, however, has come to our notice in which a cast-iron pulley worked more successfully than an aluminum one. A planer of fair size is screw-driven by means of open and crossed belts, and for the quick return, the pulley, previously of cast iron, is now of aluminum; but at the time of reversal a very distinct bump is experienced on the table, the kick in fact resulting sometimes in the loosening of the clamps securing the job. The reason is thought to lie in the rapidity with which the aluminum pulley stops, coupled with the fact that the screw is considerably worn, but not uniformly or approximately uniformly; it is, in fact, impossible to adjust the nut. To avoid the cost implied in the employment of a new screw, etc., the cast-iron pulley is to be once more put into position, the theory being apparently that it will slow down somewhat gradually, rather than cease driving immediately, and will thus eliminate the kicking action.—From English Edition of the *American Machinist*.

Pan-Americanism in Weights and Measures*

By FREDERICK A. HALSEY
Commissioner, American Institute of Weights and Measures

AT the foundation of the case for the metric system is the claim that that system is better than others. It is quite true that some who have tried it report that they find it better, but, on the other hand, others report that they find it no better and even not so good. It is, however, impossible to take a census of individuals in this matter, and it is also unnecessary because the judgment of the world has condemned the system, and the clearest verdict of all comes from France.

The metric system was originally promulgated in France by compulsory law in 1793. These laws remained in force for 19 years, or until 1812, when, under Napoleon, who had no faith in the system, they were repealed and the people were permitted to resume their ancient measures. This they promptly did, reverting to that truly universal system in which 12 in. make a foot, 3 ft. make a yard and 16 oz. make a pound.

In order to distinguish this system from the metric system by name, it received the official title the Système Usuelle—a name which, in two words, tells the whole story. This Système Usuelle continued as the common system in France for 25 years, or until 1837 when the metric force laws were reimposed.

If the metric system is better than the ancient system, were not 19 years of its enforced use sufficient to demonstrate the fact? What other explanation of this reversion to old units is possible except that the French people found them better adapted to their purposes than the new? There is no other possible explanation, and it should be noted that we have here not the opinion of a few individuals but the verdict of a nation.

Latin-American Condemnation

To the people of no other country has this opportunity been given to express their preference between the two systems after a trial of the new, but the verdict of Latin America is unmistakable. The system was adopted in most of the Latin-American countries more than half a century ago—in the decade between 1850 and 1860 and today the people use it only to the extent that they are compelled by law.

In but one country—Uruguay—is it really adopted for domestic purchases and sales and this because of laws which, to easy-going Anglo-Saxons, seem fairly grotesque. Moreover, even those laws are but partly effective as, in spite of them, we find many exceptions.

Argentina and Venezuela also have drastic laws but they are not, apparently, so rigidly enforced as in those countries we find a much larger use of the old measures. In all Latin-American countries the use of the system is in exact accordance with the severity of the laws, and in most of them among the people it is used but little. In ten of them it can scarcely be found in popular usage, while in five, the English units are used far more than the metric—although these five, like the others, are, in metric literature, claimed to be purely metric. Is not a half a century of tutelage enough to demonstrate the advantages of the metric system, if they exist? Is it not clear that the people of Latin America continue to use the old units because they find them better adapted to their purposes than the new ones?

The facts given are the results of an extended investigation conducted by the American Institute of Weights and Measures by means of a questionnaire which was circulated broadcast throughout Latin America with the assistance of the National City Bank, the United Fruit Co., W. R. Grace & Co. and the Hill Publishing Co., all of whom forwarded the questionnaires—duly translated into Spanish and Portuguese—to their branch offices and correspondents.

The results of this inquiry have been summarized in a Report on the Weights and Measures of Latin America, published by the American Society of Mechanical Engineers, and it should be noted that since its publication some remarkable combinations of its findings have appeared.

Latin-American Preference for English Measures

The preference of the people of Latin America for the ancient system is not confined to usage in domestic purchases and sales. We have an accurate census of the machine tools in Latin-American shops and factories which is a striking example of this preference.

For the benefit of the non-technical reader it should be explained that machine tools are the machines with which machine shops are equipped. They are the foundation of modern mechanical industry, being the parents of all other machines of whatever kind and purpose, since all parts of such machines are made thereon and on them every dimension of every part is determined. This is true even of the implements of war as the world has recently learned, war being, in fact, the child of the machine shop.

The census of machine tools in Latin America under prewar conditions shows that 39.3 per cent thereof were made in the United States and 43.2 per cent in Great Britain—a total of 82.5 per cent having been made to the English system—while the remaining 17.5 per cent were made in France, Belgium and Germany and to the metric system.

In other words, Latin-American factories have shown their preference for machines made to English over those made to metric measures in the ratio of nearly three to one. Knowing these facts as they do, do you think that our manufacturers of machinery will follow the advice of these well-meaning gentlemen who have no knowledge of the industry but who tell us that Latin America will not buy our machinery unless made to metric measure? Contrasting the facts with this claim, how much respect can you have for the knowledge of those who make it?

The Metric System Condemned After Trial

Next, I wish to point out that while the system has been repeatedly adopted under high hopes by industries in the United States and Great Britain, it has not made good its promises.

Twenty years ago, the Library Bureau was the star example of the progress of the system in this country. At the foundation of that industry the system was adopted for the manufacture of its products and I have in my office a statement made by a representative of that organization before the House of Representatives Committee on Coinage, Weights and Measures in 1906 in which the system was extolled to the skies and its supposed advantages set forth.

Nevertheless, after thirty years use, the system was abandoned by the Library Bureau which now manufactures its products to the English system. A similar example is found in Great Britain where, in the decade of the 90's, the Williams & Robinson Co., of Rugby, was organized for the production of the Williams' high-speed engine for which the metric system was adopted.

While continuing the system for the production of this engine, because of the difficulty of a change and the necessity of continuity of production, the system was, after 20 years use, abandoned for all new work, and Williams and Robinson summarized their experience in these words: "We are satisfied that the adoption of the metric system has cost us a great deal in gages and special tools without adequate return."

Similarly, the Ericsson Manufacturing Co., of Buffalo, N. Y., manufacturers of the Berling magneto, report that while ten years ago they used the system exclusively, they have now abandoned it.

The pioneer American watch factory—the Waltham factory—adopted the system early in its history. The Water-

*An address delivered at the Commercial Conference of the Pan American Union.

bury (now the Ingersoll) Works was established by men from the Waltham Co. who carried the system with them but beyond that the influence of the Waltham example has not gone, all other American watch factories following the English system. Similarly, the pioneer makers of steam-boiler injectors (William Sellers & Co.) adopted the system for that product, but none of their competitors has followed their example, all other makers of injectors being to the English system.

In the cases of watches and injectors, would not the advantage of the system, if it had any, have led to its use by others than the pioneers and is not the fact that others have not used it satisfactory proof that it has no such advantage? Moreover, the firm of William Sellers & Co., which adopted the system for this purpose about 1860 and which thus has a longer experience with it than any other American manufacturer, now says: "Our experience with the metric system, extending over 50 years, does not encourage us to extend its use beyond the borders of the shop and the class of work for which it was originally started."

Another example is found in the optical industry. When, a quarter of a century ago, the making of optical instruments received its great impetus in this country, it was found necessary to import skilled workmen from Europe for the grinding of the lenses. These workmen had learned their calling in the metric system in which all their formulas and working data were embodied and they naturally continued the use of the system here. It is however a striking fact that except the lenses which, numerically, are a small part of optical instruments, such instruments are made to the English system. We thus have the two systems in use side by side in the same factories, and is it not clear that if the metric system possessed the advantages claimed for it, those advantages would have led to its adoption for the remaining parts of optical instruments?

It is to be noted, moreover, that we are now discussing scientific apparatus which, although made chiefly to the English system, is accepted by scientific men as entirely satisfactory for their purposes. This being the case, by what right do these men claim that others will not accept machinery unless made to the metric system?

The investigation of the American Institute of Weights and Measures which has been published under the title "The Metric System in Export Trade" has disclosed the fact that the greatest use made of the metric system by any American industry is found in the production of machine tools and it is a striking fact that not only was this Institute organized within the machine-tool industry, but that in that industry is found the greatest number of its members. Is it not remarkable that the very industry which has made the most use of the system is the one which has combined to resist its further extension? Moreover, not only have individuals connected with this industry organized this Institute, but the National Association of Machine Tool Builders, along with other manufacturing organizations, have repeatedly passed resolutions condemning the system.

The Intellectuals Are Opposed to the System

The metric party has endeavored to convey the impression that the intellectual people of the United States and Great Britain favor the adoption of the metric system. Against that contention is a pamphlet published by the American Institute of Weights and Measures under the title "The Metric System Condemned by Those Who Know," wherein are collected together a large number of condemnations of the system by men of whom the following are representative examples: John Quincy Adams, Past President of the United States; Sir George B. Airey, Astronomer Royal of Great Britain; Association of Railway Master Mechanics; C. A. Bates, Head of Assessment Division, U. S. Treasury Department; Rear Admiral Bowles, Chief Constructor, U. S. Navy; Sir Frederick Bramwell, F. R. S.; four British Parliamentary committees; Prof. N. F. Dupuis, Dean of Practical Science, Queen's University, Canada; Rear Admiral Earle, Chief of Bureau of Ordnance, U. S. Navy; Engine Builders' Association of the United States; James W. Evans, metropolitan inspector of weights and measures, Sydney, Australia; Furniture Association of America; Willet M. Hayes, Assistant Secretary, U. S. Department of Agriculture; H. A. Hazen, Chief, U. S. Weather Bureau; Sir John Herschel, the great astronomer; J. E. Hilgard, Assistant U. S. Coast Survey; Dean William Kent, professor Mechanical Engineering, Syracuse University; B. C. Lamme, Chief Engineer, Westinghouse Electric and Manufacturing Co.; J. H. Linnard, Naval Constructor, U. S. Navy; Hon. David Lloyd George, British Premier; Quartermaster-General M. C. Meigs, U. S. Navy; Rear Admiral Melville, Chief Engineer, U. S. Navy; National Association of Manufacturers; National Association of Machine Tool Builders; National Metal Trades Association; Napoleon; C. P. Patterson, Superintendent of U. S. Coast Survey; Charles T. Porter, past president, the American Society of Mechanical Engineers; Providence Association of Mechanical Engineers; Dr. J. W. Redway, F. R. G. S., geographer, meteorological observer; William Sellers, president William Sellers & Co.; Brown & Sharpe Manufacturing Co.; Ellis Spear, Commissioner of Patents; Herbert Spencer; Dr. John E. Sweet, founder and past president American Society of Mechanical Engineers; Standards Committee Society of Automotive Engineers; F. W. Taylor, past president American Society of Mechanical Engineers, founder of Scientific Management; Hon. R. W. Thompson, Secretary of the Navy; H. R. Towne, past president American Society of Mechanical Engineers; University Convocation State of New York; U. S. War Department, office of Chief of Ordnance; J. A. Williamson, Commissioner U. S. Land Office.

The American Institute of Weights and Measures

In addition to these names, I desire to point out the character of those who comprise the Council of the American Institute of Weights and Measures which was organized to oppose the adoption of the metric system. This Council contains three past presidents of the American Society of Mechanical Engineers, a past president of the American Manufacturers' Export Association, a past president of the Mining and Metallurgical Society of America, the president of the National Association of Manufacturers and a past president of the same organization, a past president of the Society of Automobile Engineers, a past president of the National Metal Trades Association, a past president of the Society of Naval Architects and Marine Engineers, the president of the Westinghouse Electric and Manufacturing Co.; president of the Stevens Institute of Technology and the professor of Mechanical Engineering at Yale University. No other American organization can present such a list of names as this.

Against it, I wish to contrast the character of the Council of the American Metric Association which has been organized to promote the metric system. That council contains a wholesale druggist, two wholesale grocers, a professor of pharmacy, a director of a museum, a secretary of a bourse, and an expert in precious stones.

Which of these two bodies would you select to direct the industrial policy of this country?

I believe I have shown that the judgment of the world condemns the metric system.

Pan-Americanism in Weights and Measures

My Report on the Weights and Measures of Latin America has made clear to many what was formerly known to but few—the great similarity of the Spanish and the English system. Read a few of the ratios of the Spanish system:

12 pulgadas make a pie.
3 pies make a vara.
16 onzas make a libra.
2,000 libras make a tonelada.

These ratios are equally familiar to us all and the onza, the libra and the tonelada differ from the ounce, the pound and the ton by one-half of 1 per cent—a difference so small as to be inappreciable for most purposes; a difference so small that in five of the Latin-American countries, it is now ignored as it might easily be in all.

Do you recognize what I am coming to—Pan-Americanism

in weights and measures—the unification of our weights and measures on the basis of that system which is no more English than it is Spanish and no more Spanish than it is English because it is neither. It is Roman. I am here to urge Pan-Americanism in weights and measures without change of system and with nothing but an adjustment of values to agreement. Pan-Americanism did I say? Aye, but much more than that. Great Britain and her far-flung Empire; the United States, which has taught the world how to do without kings; Latin America, the land of the great and glorious future. What more is needed to stir your blood? What more to send it coursing through your veins in the presence of a great opportunity? I am not here to deal in fine words or phrases. I am here to present a simple, sensible, practicable plan for the promotion of the commercial relations of the two Americas and of the British Empire.

Let us give up the chase of this will-o'-the-wisp which the nations of the world are always chasing but never catching.

Let us consult the experience of the past. Let us recognize that the attempt to adopt the metric system is a failure. Let us work for what is feasible, possible and practicable.

Let us unify the weights and measures of the two Americas and of the British Empire on the basis of the system which came to us all from the mother of us all—the Roman Empire.

What more sane, simple, sensible, obvious, practical, common-sense method of promoting the commerce of the two Americas is there than this? What more fruitful thing can the Pan-American Union do than promote this object?

For what are we here? Is it to promote that threadbare, discredited thing, the metric system, or is it to promote international trade and commerce?

Books As Tools

BY E. A. GOEWAY

The American employer, still striving to overcome the many unusual business and financial conditions which have followed in the wake of the war, is becoming more and more convinced that among the most serious features of his problems are a pronounced shortage of labor and a dearth of workers skillful to the point of high proficiency.

The quantity demands of the war period no longer are maintained in many industries, and the American employer soon must face a sharp foreign competition. However, he is not losing sight of the fact that, in the long run, quality rather than quantity will stabilize "Made in America" goods in the markets of the world. But, to do this, the native manufacturer must obtain employees who are thoroughly capable, in order that the products of the United States may equal in every way the best produced abroad.

How can he obtain this much-desired efficiency on the part of his employees?

To this query there are many answers, but there is no question that one solution of this difficulty points straight to the magic gateway to erudition—books. Already, in line with this thought, many far-seeing manufacturers and heads of business institutions have installed in their plants special libraries of technical books for the use of their workers, as well as for reference by themselves. From these libraries the worker may obtain books giving the most minute information upon the industry in which he is employed, and such books are in demand both during the lunch hour and for quiet reading at home. This plan is not a tentative scheme, but an established fact; and in the places where it has been followed it has met with the greatest favor on the part of both the employer and the worker.

When the country is considered as a whole, there is still a deplorable lack of good libraries in business houses, shops, mills and factories. Every employer should be brought to see the benefits to be derived from these special libraries; and an important step toward this has been taken by the American Library Association in its Enlarged Program, which is being carried out with the significant slogan, "Books for Everybody."

At the present time the A. L. A. is supplying books to the men in the Public Health Service Hospitals, to the sailors of the American Merchant Marine, to the coast guards and lighthouse keepers and to discharged soldiers.

The Enlarged Program contemplates doing many things toward an even more general extension of the library service, emphasizing four outstanding purposes.

One of these, and a very important one indeed, is to encourage a larger use of the technical books now in

THE WELL-EQUIPPED READING ROOM OF THE NATIONAL CASH REGISTER PLANT

the public libraries and to urge employers of labor in factories and plants to install special libraries of technical books for the use of their employees. The Special Libraries Association is giving its aid toward this campaign. The A. L. A. will also endeavor to bring about the extension to all parts of the country of the county library system, which is now successfully in operation in a number of states, so that the dwellers in even the smallest hamlets may be brought in intimate touch with the newest and best books.

It will attempt to further the movement to have a greater number of books printed in the standard Braille type for the use of the blind. It purposes to assist the new Americans, who number several millions, to become better citizens by seeing to it that they are supplied with books dealing with American ideals, aims, and traditions. To carry out this latter purpose publishers will be asked to print, in various foreign languages, some standard American works which come under the above classification, so that the immigrant upon arriving in this country may have this literature placed in his hands in the language which he will understand most easily. To carry out this Enlarged Program the American Library Association will raise a fund of $2,000,000, not, however, by an intensive drive or campaign, but through the librarians, library trustees and friends of libraries.

Lapping and Measuring Small Cylindrical Plugs

By HUGO F. PUSEP

The lapping of very small cylindrical surfaces has problems all its own, and, although not difficult of solution, the mechanic has to know how to go about it in order to attain good results with a minimum of experimenting. In the following contribution the author has endeavored to explain as clearly as possible the methods and the reasons therefore of lapping and measuring small cylindrical surfaces to a minute degree of accuracy.

IT IS a well-known fact that as tools decrease in size the skill of the toolmaker must increase in proportion. This is shown clearly when we consider the finishing of small cylindrical surfaces to very accurate limits. Small plug gages, slender piercing punches for sub-press dies, measuring wires for various purposes, and all similar work demand a high degree of accuracy which can only be attained by careful workmanship and correct practical methods.

On larger cylindrical work it is the practice to grind to within two- or three-tenths of size, after which the work is finished with a lap. This method is practical down to comparatively small diameters, but grinding becomes anything but satisfactory on pieces less than $\frac{1}{8}$ in. in diameter. Although work as small as $\frac{1}{16}$ in. in diameter has been ground with a fair degree of success, as a general rule chattering and springing of the work in sizes below $\frac{1}{8}$ in. tend to defeat the desired end. This is particularly unavoidable where the work to be ground is of any considerable length.

Drill rod is almost exclusively used for small work because it is available in the small sizes likely to be required. For purposes of illustrating the various steps that are necessary to the production of small cylinders, let us assume that a hardened steel plug 2 in. long is required to be parallel and 0.032 in. in diameter, and well within 0.0001-in. limits of accuracy.

For this plug, the most suitable size of drill rod would be No. 65 (0.035 in.). This size, it will be noticed, is about 0.003 in. larger than that of the finished plug. This oversize will take care of shrinkage in hardening and will provide ample material to be removed so as to leave a perfectly clean surface after finishing. As a general rule, the drill rod for any given size of plug or wire should be at least 0.002 in. larger to begin with.

After cutting off a piece of drill rod about $3\frac{1}{2}$ in. long it is filed down as shown at *A*, Fig. 1. This is done in a bench lathe with a narrow pillar file. The clearance groove, as it is called, may be about $\frac{1}{4}$ in. long and should be filed to the ultimate diameter of the plug, or at the most only a thousandth or so smaller. The longer end of this wire is then hardened and drawn to a suitable temper, after which it is ready for finishing.

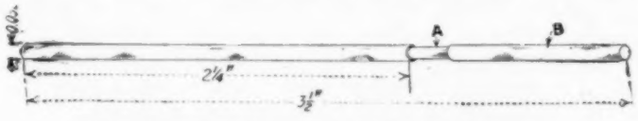


FIG. 1. THE PLUG READY FOR LAPPING

Lapping is the only method whereby accurate results can be obtained. On large work of this nature anything resembling an external lap could be used successfully whereas small work demands a lap particularly adapted to it. The operation of lapping is divided into two stages—roughing and finishing—the form of lap, however, being identical for both.

An ideal form of lap is shown at *A*, Fig. 2. It is made of close-grained cast iron and, although very simple, has some points about its construction that are, no doubt, new to mechanics not familiar with this class of work. The different stages in the making of this lap are shown at *B* and *C*, Fig. 2.

The lap is made double ended in order to utilize one end for roughing and the other for finishing. After planing up a rectangular cast-iron plate *B*, the two lapping holes *D* are drilled. It is well at this stage to mark the holes "R" and "F," as at *A*, Fig. 2, meaning roughing and finishing, to avoid confusion later on. The roughing hole is drilled out a slip fit for the hardened drill-rod plug which it is to lap, while the finishing hole is made about 0.0005 in. larger than the finished size of the plug. It is a comparatively easy matter to drill these holes to the right size by selecting the proper size twist drill, but under no consideration should one attempt to finish either hole with one drill. A drill that is a few thousandths undersize should be used first and the second drill employed as a sort of reamer. If the corners of the reaming drill are honed off care-

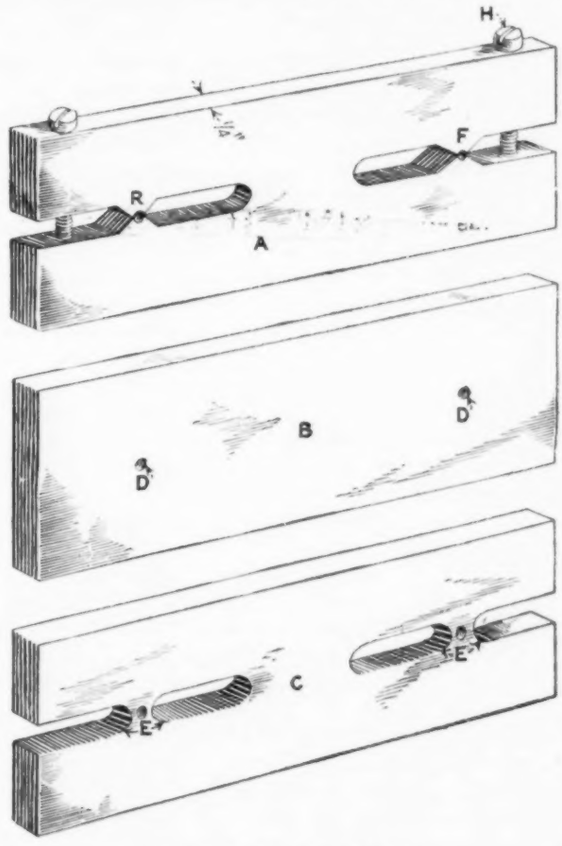


FIG. 2. MAKING THE LAP

fully, a very smooth hole can be made. Should occasion arise where the right size of drill is not obtainable, an improvised gun drill, well known to most toolmakers, can be made of drill rod for reaming to any size required.

The elongated slots *E* are now worked out to convenient size by drilling and filing. In the final stages of making this lap, a three-cornered, or a knife-edge, file according to size of the holes, is used for filing the V's in such a manner that they will just break through the lapping hole from opposite sides, as shown at *A*. A glance at the enlarged diagrams in Fig. 3 will show the futility of using a saw blade—even though but 0.010 in. in thickness—for slotting a lapping hole 0.020 in. in diameter as at *A*. Slotting the same lap if done with a small file, will leave a lapping surface which is practically unbroken. Two small fillister-head screws for adjusting the tension will now complete the lap.

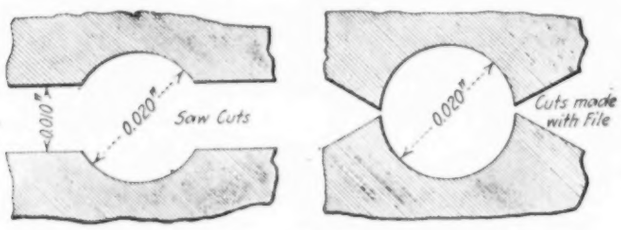


FIG. 3. FUTILITY OF SAWING OPEN THE LAP

The thickness of this lap should be about ¼ in., consequently giving that length of lapping surface. Although there is no set rule, the writer has found that even on extremely small sizes the lapping surface should not be less than $\frac{3}{16}$ in. in length in order to have the lap function properly.

The plug shown in Fig. 1 is now ready for lapping, being held by the short end *B* in the bench lathe collet or chuck, leaving the long end, and the recess *A* extending. Thus the lap will clear itself at each lapping stroke over this recess, thereby preventing the lap from wearing bellmouthed. It will also prevent it from seizing on the plug, which would surely be the case if the lapping was attempted without this clearance groove.

Should a wire be too small for the smallest collet, a simple adapter can be easily made from a short piece of round cold-rolled steel of a size to fit the smallest collet—which usually has a ¼-in. hole—by drilling a slip fit hole for the wire and then sawing it longitudinally as shown at *A* in the enlarged sketch, Fig. 4.

This saw cut does not run into the central hole, however, but comes a little short of it, so when the opposite side is split with a sharp V-form as at *B*, the collet, on being tightened, will spring the adapter sufficiently to hold the wire firmly against the strain incidental to lapping.

Although the actual operation of lapping small-diameter wires differs but slightly from that of any larger cylindrical work, there are several points of importance to be considered. Nothing coarser than emery flour should be used for both the rough and finish lapping. Very good results are obtained by using 1F grade for the rough lapping, and 6F for finishing. The 1F grade leaves a finish that appears smooth to the naked eye, but the magnifying glass will disclose a multitude of minute grooves. The purpose of the very finest grade of emery flour for finish-lapping is to practically eliminate these grooves.

After the roughing lap has reduced the plug to within 0.0005 in. of size, the lap, plug and bench lathe are cleaned thoroughly; in short, every precaution is taken that the two grades of lapping compound do not get mixed. In finish-lapping only a very small amount of emery flour is used, lubricating the lap frequently with pure lard oil. Too much emphasis cannot be laid on using only the best oil obtainable, because it will aid materially in producing a mirror-like finish. Very little pressure is exerted on the finishing lap. It should be held with finger tips alone; then all the high spots on the plug can be easily "felt" and reduced accordingly.

When the wire is getting close to size the lap is washed clean of all loose emery and then used with oil

FIG. 4. ADAPTER FOR HOLDING ODD-SIZED WIRES

alone. Move the lap back and forth over the length of the plug in methodical strokes. Referring to Fig. 1, let us assume that the bench lathe is running at its highest speed; a good average time for the lap to travel 2½ in. would be about one second. This stroke is necessary for the purpose of eliminating all traces of circular grooves on the surface of the plug. All high spots, however minute, will likewise be eliminated.

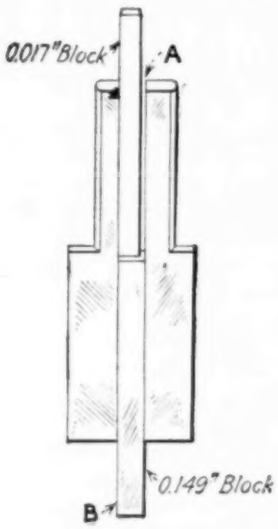


FIG. 5. THE METHOD OF GAGING

Frequent measuring is imperative toward the end of the finish-lapping. The micrometer which has been used exclusively up to now, is dispensed with. The degree of accuracy of the plug now depends entirely on the measuring equipment used in the final stages.

In shops where precision gage blocks are available, they furnish ideal means of measuring this class of work by direct reading. Taking our plug of 0.032 in. in diameter as an illustration, we select two blocks whose difference in size equals 0.032 in. The largest block of the two—in this case, let us say 0.149 in.—is wrung between the two regular jaws of the gage set, as illustrated in Fig. 5. Then the smaller block, namely, 0.117 in. thick, is also wrung onto one of the jaws as clearly shown on the sketch, leaving a space *A* exactly 0.032 in. wide. This set-up is secured in an upright position on a surface plate by clamping the end of the lower block *B* in a parallel clamp, protecting the gage block with fiber or other soft material.

Preparatory to measuring, the plug is washed in

clean gasoline, wiped dry and then laid on the surface plate alongside of the gage set-up. In a few moments the temperature of the plug will become the same as that of the surface plate and gages. The plug is now entered into the opening *A*, Fig. 5, and should it be possible to slide it down till it touches the lower block *B* without spreading the jaws and causing them to fall apart; then the plug must be 0.032 in. in diameter, plus or minus an infinitesimal quantity.

Two similar sets should be made up or other gage blocks, one giving the size plus 0.0001 in., and the other the minus limit; any four gage blocks will serve as jaws in this instance. With three sets thus arranged it will seem really remarkable how easily such a small quantity as one ten-thousandth inch can be measured.

The short end *B*, of Fig. 1, which has been used so far for the purpose of holding it in the bench lathe collet, is now secured in a soft-steel handle. If used for other purposes than a plug gage, this soft end is treated to suit the particular needs of the case.

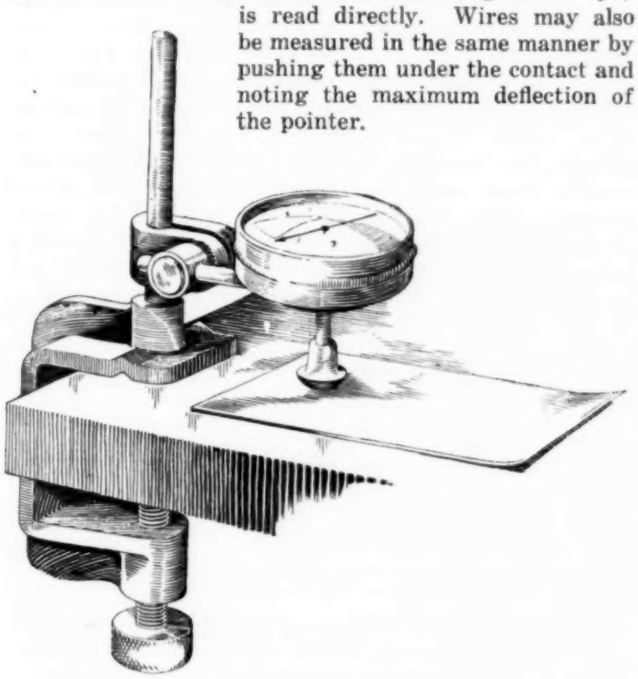
Dial Indicator Used as Direct-Reading Thickness Gage

By H. H. Parker

An ordinary dial test indicator makes a most convenient direct-reading thickness gage, and, when the accuracy of its readings is sufficient for the purpose, it saves all the trouble of handling a micrometer and figuring out its readings.

The device is merely clamped to a surface plate or other accurate and smoothly finished surface with the contact button touching the surface of the plate. After setting the pointer to zero, the piece to be measured is slipped between the plate and button and its thickness may be read at once.

Another method is to slip a standard piece under the gage and then turn the dial to register zero. After the standard piece is removed, others are slipped into place and the plus and minus amounts by which they differ from the standard (the dial reading both ways) is read directly. Wires may also be measured in the same manner by pushing them under the contact and noting the maximum deflection of the pointer.



USING A DIAL INDICATOR AS A THICKNESS GAGE

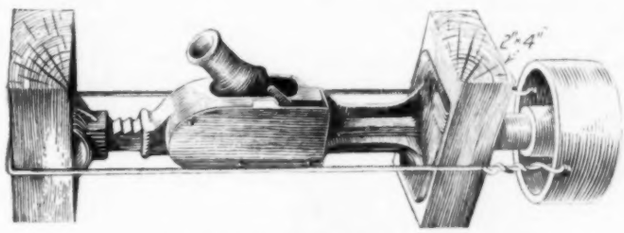
Another Use for the Jack

By Gustave A. Remacle

While jacks are made primarily for the purpose of lifting, I recently discovered that they, like the screwdriver, can be used for many purposes.

I was helping a young automobile man to take apart a Ford motor when we were brought to a halt by the disk drum which had rusted fast to the transmission shaft. The drum had resisted all our efforts to remove it by means of prying and hammering.

After a few moments' reflection the young chap brought out a little one-ton jack and rigged it up as shown in the sketch. The piece of stout wire was bent



HOW THE JACK WAS USED

and fastened to the drum as shown. The two pieces of two by four were used to keep the wire clear of the jack. With this set-up and the powerful little jack in action, the stubborn drum began to move, reluctantly but surely.

To date I have never seen a jack used in the machine shop for any other purpose than lifting or supporting. There are probably many instances where a jack could be used to advantage in the machine shop. If the line of work does not warrant having a jack in the tool crib, one can be borrowed for an emergency, from the boss' car which stands in front of the shop.

Calculating Gears for Practical Threads

By J. Crommell

All the instructions (so far as I have seen) for calculating the gears to be used in cutting fractional threads, involve the figuring of the number of turns of the work and lead screw and their relation to the gears. This is like a problem in square root; if you don't get mixed up this time, you will the next.

To find the number of threads to the inch when a fractional lead is given, all you have to do is to invert the fraction. For instance if the lead is $\frac{7}{8}$ in. the number of threads per inch will be $\frac{8}{7}$ or $1\frac{1}{7}$; if it is $\frac{3}{8}$ the number will be $\frac{8}{3}$ or $1\frac{2}{3}$ to the inch.

Suppose you get an order to cut a $\frac{7}{32}$-in. lead on a certain piece; this equals $\frac{32}{7}$ or $4\frac{4}{7}$ threads to the inch. You put a 32-in. gear on the lead screw of the lathe and multiply the lead of the latter by 7; that is, if the lead of the lathe screw is 4, then $4 \times 7 = 28$, the gear to put on the stud; if the lead is 5, then $5 \times 7 = 35$, representing the stud gear required.

In multiplying by 7 you have (probably without being aware of it) multiplied $4\frac{4}{7}$ by $7 = 32$, and to keep the proportion you multiply the lead of the lathe screw by the same number.

All apparently difficult thread problems are nothing more than simple proportion, just as you used to do it in the little red school house.

The Langelier Hot Swaging Machine

By E. L. DUNN
Associate Editor, *American Machinist*

Machine swaging in its various forms has been practiced for many years, the art of which has been described in the "American Machinist" as far back as 1896 and as recently as Dec. 11, 1919. The purpose of this article is to describe a certain type of swaging machine and its work.

SWAGING machines of modern design are not commonly known and are seldom seen in the average shop equipment, particularly the late models of large size that are designed to handle a special line of work. Such a machine, shown in Fig. 1, was recently built and tested in the shops of the Langelier Manufacturing Co., Providence, R. I. It was designed especially to form a U-shaped joint uniting a pair of pipes, but is not limited to this one class of work, as it can be used to a decided advantage on many forms of straight work.

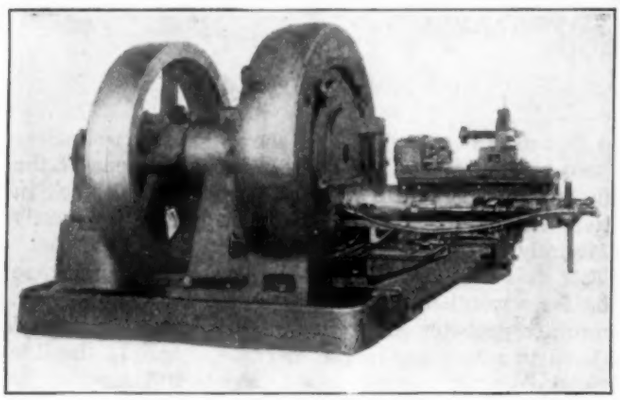


FIG. 1. THE LANGELIER 8 HS 9 SWAGING MACHINE

Specifications: Number of machine, 8 HS 9; capacity tubes, 5⅛ in., rods, 2¼ in.; r.p.m of flywheel, 150; air pressure required, 90 lb.; hydraulic pressure, 125 lb.; size of motor, 40 hp.; speed of motor, 900 r.p.m.; size of machine base, 54¼ x 88¾ in.; floor space required for operation, 138¾ x 118¾ in.; height of machine, 78 in.; approximate net weight, 16 tons.

Combined Langelier Features

The design employs standard Langelier construction combined with a number of special features. The swaging dies are arranged to operate in the usual manner common to machines of this type. The operation may be readily understood by reference to Fig. 2, which shows the arrangement of the dies, rollers, etc., in the machine head. Briefly described, a pair of oppositely disposed swaging dies are carried in the spindle head and are caused to open and close rapidly as the spindle revolves. The dies are opened by centrifugal force and are closed or squeezed together, when passing between a pair of fixed rollers, located in the stationary head, it being understood that suitable hammer blocks are interposed between the dies and the rollers. There are six pairs of the fixed rollers that form a circle around the spindle head, consequently the dies are forced together six times during each revolution of the spindle. As the machine runs at a speed of 150 r.p.m., the dies deliver 900 blows per minute, and the work is thus swaged, or hammered into shape as it is fed into the dies. The work saddle, or carrier, arranged in front of the machine head, is provided with air operated clamping jaws for holding the work. The saddle is moved on its slide-ways by haudraulic pressure, the movement being controlled by a hand valve.

Swaging Operation

When two pipes are to be joined in the form of a U-shaped bend, as shown in Fig. 3, they are first welded together by hand, with the ends forming a single opening, as shown in Fig. 4. The pipes thus united by the incomplete bend are again heated to welding temperature and then properly located between the clamping jaws, one pipe above the other. The clamping jaws

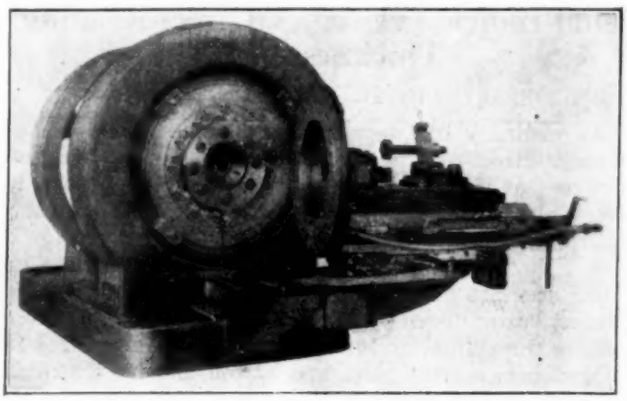


FIG. 2. SADDLE HEAD SWUNG ON ITS HINGES TO SHOW ARRANGEMENT OF DIES AND ROLLERS

have forwardly extending, reinforcing members which fit snugly into the curvature of the bend at each side, thus holding it rigidly in place during the swaging operation, and counteracting the twisting force exerted by the rapid rotation of the swaging dies. The jaws are closed initially with a moderate clamping effect by a manually operated handle, but as the work saddle moves slowly forward forcing the incomplete bend between the swaging dies, the jaws are automatically brought closer together, gripping the pipes with great pressure. This is accomplished by means of the pneumatic device, which is shown in Fig. 5. The controlling valve is governed by movement of the work saddle and is operated by a lever and cam arrangement located at the opposite side and shown in Fig. 1. As the

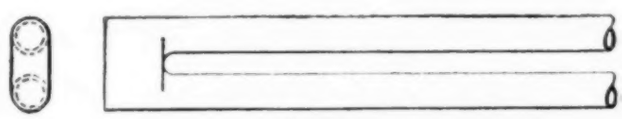


FIG. 3

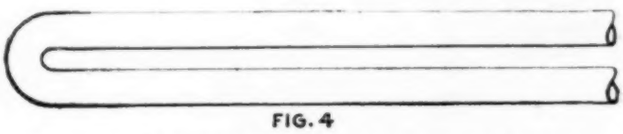


FIG. 4

FIG. 3. THE INCOMPLETE JOINT BEFORE SWAGING
FIG. 4. THE COMPLETED U-JOINT AFTER SWAGING

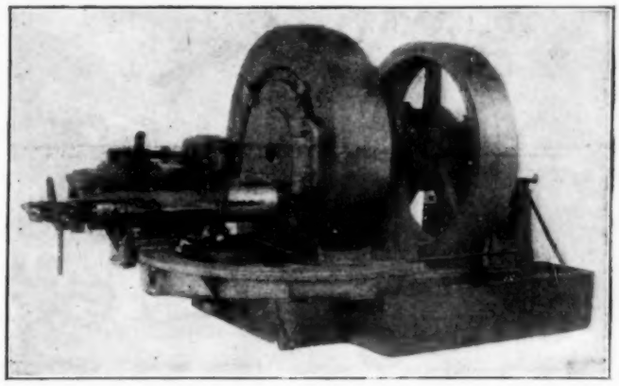


FIG. 5. SHOWING ARRANGEMENT OF AIR OPERATED CLAMPING JAWS

unfinished joint is forced into the vibrating dies its opening is closed and the metal consolidated in the form of a U-shaped bend. The joint being complete, the projecting tit is cut off and its root smoothed down by land with the aid of a swaging hammer. The bulge in the bend, caused by the swaging operation, is straightened or flattened out in a suitable press. A structurally defective or deformed bend is prevented by the manner in which the work is first securely seated in place and then gripped and supported by the clamping jaws.

Other Work of Machine

In addition to forming U-joints as above described, the machine is capable of turning out a large variety of straight work such as shown in the line cut, Fig. 6. The tubes shown were each heated and swaged at one pass and turned out at the rate of two tubes per minute, the machine being equipped with the automatic clamping jaws and running at a speed of 150 r.p.m. On work of this character the machine has a capacity for tubes as large as 5½ in. in diameter and rods as large as 2½ in. in diameter.

Owing to the great size of the machine and heavy weight of the parts, a curved base support, shown plainly in Fig. 2 and Fig. 5, is provided to support the outer end of the work-saddle mechanism. A special foot attached to this rests upon the base support and relieves the hinges of weight when the saddle arrangement is swung to one side, as shown in Fig. 2. The entire machine is solidly constructed and all details have been taken care of so as to produce a unit of great strength and endurance. The machine head is provided at the back with a cored and webbed chamber, having wide ports through which a continuous flow of water is maintained either by city pressure or by means of a small pump. This cooling provision permits the machine to be continuously operated on hot stock and greatly increases its efficiency. The machine spindle is exceptionally large and heavy, of hammered steel turned and ground, bored throughout its entire length and slotted diametrically across the enlarged head. A circular steel ring, tongued and screwed in, greatly strengthens this open end. The sides of the slot are lined with hardened steel plates riveted in place. The spindle runs in loose cast-iron, perforated, sectional bushings that are turned and ground. These slowly creep around as the spindle revolves, giving about 50 per cent more bearing surface, and making it possible and inexpensive to replace them when worn out, without requiring that the entire head of the machine be sent back to the factory for repairs, as would be the case if the spindle revolved directly in a solid head, or a solidly bushed head. The full power of the flywheel, exerted on the dies, explains the ease and rapidity with which the machine produces the great reductions of different pieces accurately to size without chatter marks, and at a speed not possible by any other process. The 40-hp. motor handles the work readily and with ample reserve power as full-load requirements seldom exceed one-half that amount.

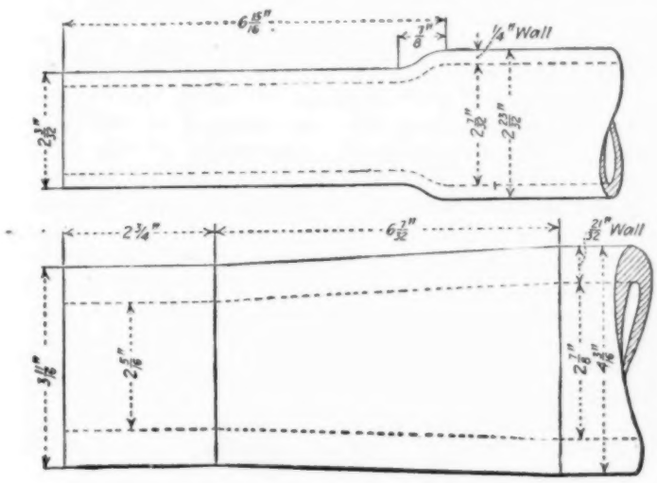


FIG. 6. SAMPLES OF TUBE SWAGING

An Oxy-Acetylene Welding Job

By A. F. Morton

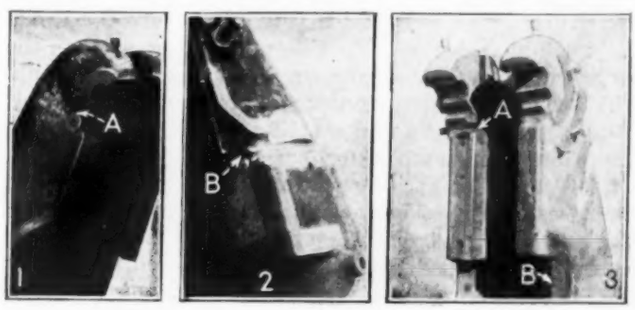
The illustrations show two breaks in a press frame that were successfully welded by the oxy-acetylene process.

The first break occurred at *A*, Fig. 1. This was welded and the press was back in service in 18 hr. No reinforcing metal was added to the surface of the casting and the bearing was in such good alignment that no work on it was necessary.

After about six months' service the frame cracked on the opposite side and lower down, as shown at *B*, Fig. 2. The crack appears larger than it actually was, as considerable metal had been cut away to make a good weld.

The location of the crack made preheating necessary. The job was completed and returned to the owners in 48 hr. and the press is again giving good service.

Fig. 3 shows the first break at *A*, while the last one, after the weld was completed, is shown at *B*.



THE PRESS FRAME SHOWING THE WELDS

Fig. 1—The first break after welding. Fig. 2—The second break (ready for welding). Fig. 3—Both breaks after welding.

Firing Orders of Internal Combustion Engines

By K. H. CONDIT
Managing Editor, *American Machinist*

This discussion of the firing orders of gas engines in everyday use is presented for the benefit of the man who likes to play with experimental engines but who has never had time to go very far into the reasons why. Much of the difficulty caused by the unfortunate lack of uniformity in the method of designating cylinders can be overcome if the method described here is followed. The method is not new but does not seem to have been adopted universally by any means.

SO MANY people have trouble in figuring out what the firing order of an automobile or airplane engine is or ought to be that it has seemed worth while to work out this little system to show how easy the whole thing is. It must be understood that this scheme is based on the usages of common practice and may not cover all the freak engines that have been built and made to run. There are also a few exceptions to the general practice which only go to prove the rule.

The simplest multi-cylinder engine in general use at the present time is, of course, the four-cylinder type. Experience has proved that a crankshaft with the outer crankpins, No. 1 and No. 4, in line with each other, and with the inner ones, Nos. 2 and 3, in line with each other, but 180 deg. away from the outer ones, gives the best results. Fig. 1 shows such a shaft. With this arrangement it is evident that a four-cylinder, four-cycle engine can only fire two ways, either 1-2-4-3 or 1-3-4-2, for the impulses occur at intervals of 180 deg. of crankshaft revolution. The duration of the four-stroke cycle is 720 deg. and the interval for even spacing will be 720 deg. divided by the number of cylinders.

A Chronological Experiment

There is a story that in the early days of automobile construction there was a manufacturer with a very orderly brain who conceived the notion that 1-2-3-4 would be much more logical or perhaps chronological than the ordinary way. He built an engine with a special crankshaft to give this firing order and even got so far as putting it in a chassis and starting it. It ran all right, but showed a marked disinclination to stay with the rest of the car. The rocking motion set up by the wave of impulses soon broke every holding-down arrangement that could be devised. They finally gave it up, put in a conventional crankshaft and camshaft and the motor ran beautifully without the slightest tendency to rock. That settled the chronological idea.

The eight-cylinder, V-type firing order naturally comes next as it is based on either one of the four-cylinder orders just mentioned and because the eight uses the same shaft as the four, two connecting-rods being attached to each crankpin instead of one.

Here we strike a snag in the various methods of designating cylinders. In the four this does not make so much difference, for the same result is arrived at no matter which end you start from. There is little doubt that the best and most logical method to follow is to number the cylinders from 1 to 4 right and from 1 to 4 left, commencing from the starting crank end of an automobile engine and from the end opposite the propeller end of an airplane engine. This makes the output end of each engine the one with the highest-numbered cylinder nearest to it. Fig. 2 shows diagrammatically this system of numbering applied to eight-cylinder engines.

Firing Orders of an Eight

Assuming that our cylinders are numbered this way, and that our cylinder blocks are inclined at 90 deg., which is customary, we can evolve two firing orders from each four-cylinder firing order. The firing interval will be 90 deg. and the firing order will alternate between the two blocks. The easiest order to work out will be obtained when opposite cylinders, that is, the ones whose connecting-rods are fastened to the same crankpin, fire consecutively. Application of this principle gives two firing orders, 1L-1R-2L-2R-4L-4R-3L-3R and 1L-1R-3L-3R-4L-4R-2L-2R.

Reference to Fig. 2 will show that instead of firing opposite cylinders such as 1L and 1R we could fire cylinders whose rods come to different pins which are in line, for example, 1L and 4R or 2L and 3R. The only changes necessary in the engine would be in the camshaft and wiring. The other two firing orders are then 1L-4R-2L-3R-4L-1R-3L-2R and 1L-4R-3L-2R-4L-1R-2L-3R. It is probable that the engine balance is slightly better with either of these arrangements than with the first two mentioned.

So far nothing has been said about the direction of

rotation of the crankshaft. In automobiles the rotation is clockwise when the observer stands in front of the car, except in a very few cases, notably an old Stearns model. With an electric starter fitted to the engine it

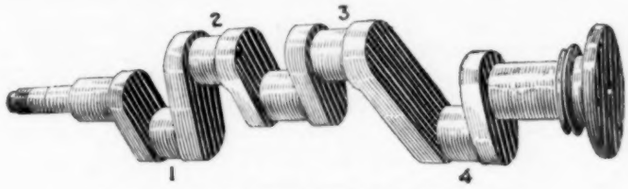


FIG. 1. FOUR-CYLINDER CRANKSHAFT

really makes very little difference to the operator which way the crankshaft turns, but before the days of starters when "tail-twisting" was in vogue, the natural right-handedness of the big majority of the population dictated the direction of rotation.

Direction of Rotation of an Airplane Engine

When it comes to airplane engines all sorts of contradictory ideas are encountered. With a direct-drive tractor the usual way is to call the motor a clockwise motor if the pilot, as he sits in his seat looking forward along the cylinders, sees the propeller describing clockwise circles. If the propeller is driven through reduction gearing the question arises as to whether to judge by the rotation of the propeller or of the crankshaft. It would seem better to judge by the crankshaft, although this is not the usual practice, because the type of reduction gearing used on the Rolls-Royce drives the propeller in the same direction as the crankshaft rotation, while in the Sturtevant the directions are opposite.

Still further confusion results when we take the rotating cylinder type into account. Here the observer stands out in front of the airplane and determines the direction of rotation from that position. Consequently, a counter-clockwise Gnome or Le Rhone engine will rotate a propeller in the same direction as a clockwise Curtiss or Liberty engine.

To simplify this discussion we will decide the direction of rotation from the crankshaft, the observer standing in front of the engine; that is, at the end opposite the output end. This will help in the consideration of six-, twelve-, and eighteen-cylinder engines, all of which use the same type of crankshaft.

The six-cylinder shaft is built in two ways which are arbitrarily called right-hand and left-hand, this distinction having nothing whatever to do with the direction of rotation. Fig. 3 shows views of both arrangements of crankpins. When the observer stands in front of a

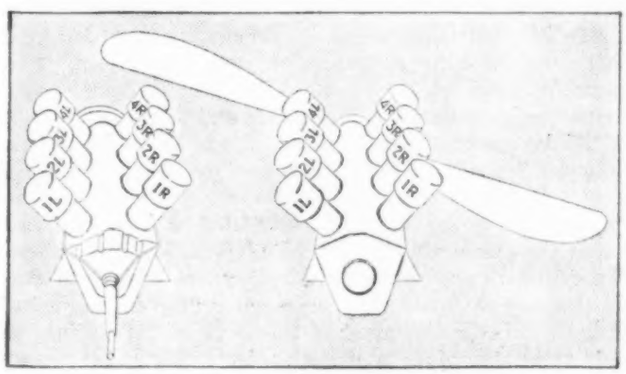


FIG. 2. EIGHT-CYLINDER AUTOMOBILE AND AIRPLANE ENGINES

right-hand crankshaft which has been rotated so that crankpins 1 and 6 are vertically upward he will see the center crankpins, 3 and 4, to the right of the center line and 2 and 5 to the left. This is reversed for the left-hand shaft.

The crank arms are at 120 deg. to each other to give even firing angles of 120 deg. This value is determined as before by dividing the total duration of the cycle, 720 deg., by the number of cylinders. A glance at Fig. 3 will show that the number of possibilities in the firing order of the cylinders is greater than with the simpler crankshaft. If we rotate the right-hand shaft clockwise, we could fire the cylinders in the two orders 1-2-3-6-5-4 and 1-5-3-6-2-4. Experience has shown, however, that it is not advisable to fire adjacent cylinders consecutively, and, consequently, we can eliminate the first arrangement as unsatisfactory. The second arrangement is then the one to be expected when the shaft under consideration is a right-hand shaft and rotates

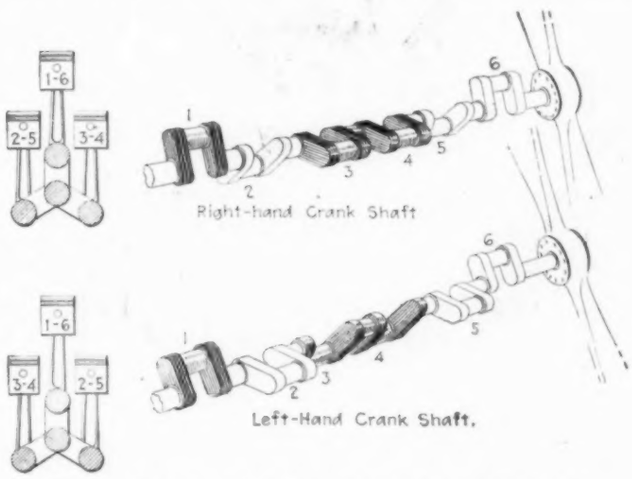


FIG. 3. RIGHT- AND LEFT-HAND SIX-CYLINDER CRANKSHAFTS

clockwise. A little study will show that it is also the firing order of the left-hand shaft turning counter-clockwise.

It might be well to mention at this point the ways of determining the direction of rotation of the crankshaft. If the engine is assembled it is only necessary to turn the shaft slowly by hand, watching the valves on any one cylinder during the process. If the inlet valve is seen to open immediately after the closure of the exhaust valve, the direction of rotation is correct.

With the engine disassembled, an inspection of the camshaft to determine the relative positions of the cams which open the valves of any one cylinder will answer the question. The relative directions of rotation of the camshaft and crankshaft due to the type of gearing used must be taken into consideration, as in the average L-head motor the directions are opposite, while in some overhead-valve types they are the same.

Returning now to our right-hand crankshaft—if we rotate it counter-clockwise we get the firing orders 1-3-5-6-4-2 and 1-4-2-6-3-5. The first is bad because 2 and 1 and 5 and 6 are together, but is in use on at least one six-cylinder engine, that installed in the 120-hp. Holt tractor. The other is the conventional one and will also apply to the left-hand shaft when rotating clockwise. This exhausts the reasonable possibilities and leaves us with practical firing orders, 1-5-3-6-2-4 and 1-4-2-6-3-5.

Just as tne V-type eight is a double four so the V-type twelve is a double six or twin six, as it is sometimes called, and uses a six-cylinder crankshaft, either right- or left-handed. The direction of rotation is ordinarily clockwise, although some airplane engines for multi-engined machines turn counter-clockwise to equalize the torque.

The normal firing angle of the V-type twelve is, of course, 60 deg., but in some airplane engines, the Liberty, Renault and Lancia, for example, this angle has been reduced to cut down the width and consequently the head resistance of the engine. This sacrifices the even firing angle, but apparently has no particularly detrimental effect on the running of the engine. The

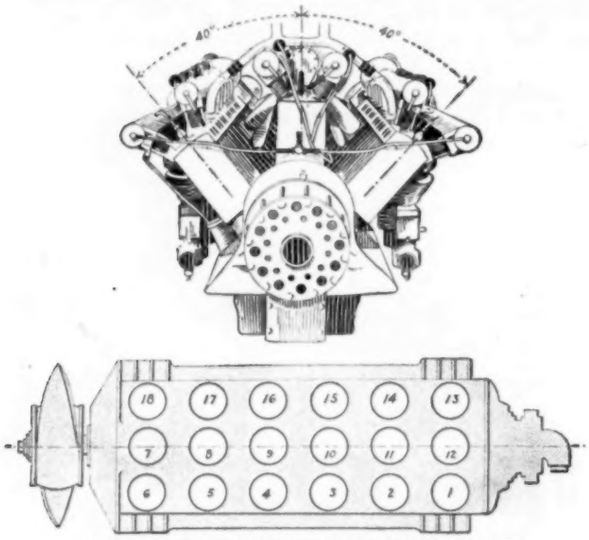


FIG. 4. THE 18-CYLINDER W-TYPE AIRPLANE ENGINE

change, however, has nothing to do with the firing order.

If we number our cylinders as we did those of the eight, from 1 to 6 right and 1 to 6 left, we can, by applying the same reasoning, obtain four twelve-cylinder firing orders, as follows: 1L-1R-5L-5R-3L-3R-6L-6R-2L-2R-4L-4R, 1L-1R-4L-4R-2L-2R-6L-6R-3L-3R-5L-5R, 1L-6R-5L-2R-3L-4R-6L-1R-2L-5R-4L-3R, 1L-6R-4L-3R-2L-5R-6L-1R-3L-4R-5L-2R.

The third one is in most common use, as most twelve-cylinder engines use right-hand shafts turning clockwise.

We can go one step further with this development and take in the 18-cylinder W or broad-arrow type exemplified by the 18-cylinder Sunbeam, which is essentially a V-type twelve with an extra row of six cylinders down the middle. Assuming that a right-hand, clockwise crankshaft is used, we can readily work out the firing order of this type if we know one other fact about it, that the cylinders opposite each other on the outside banks fire in the same group with the center cylinder whose rod comes to the other crankpin in line; that is, 1L and 1R, whose connecting-rods come to No. 1 crankpin fire in the same group with 6C, whose rod comes to No. 6 crankpin. The firing angle is 720 deg., divided by 18 or 40 deg., and the angles between the cylinder blocks are 40 deg. as shown in Fig. 4.

If we follow through the scheme just outlined, we can obtain the firing order which follows: 1L-6C-1R-5L-2C-5R-3L-4C-3R-6L-1C-6R-2L-5C-2R-4L-3C-4R. This makes use of our standard method of cylinder numbering and is comparatively easy to remember or work out. The maker numbers the cylinders in the manner shown at *A*, Fig. 4, and his method of numbering makes the firing order read 1-7-13-5-11-17-3-9-15-6-12-18-2-8-14-4-10-16. There is apparently no rhyme or reason to this, although it is just the same as the other one and it would take a memory expert to figure out a scheme by which to remember it without chance of mistake. The same applies to twelves and eights, which are numbered to suit the fancy of the designer, with the exception of the little Curtiss airplane engine, which has a firing order, using the maker's numbers, that almost repeats itself—1-2-3-4-7-8-5-6.

Nothing has been said about the eight-cylinder-in-line, 12-cylinder W-type or 16-cylinder twin engines because they are not in common use and have hardly emerged from the experimental stage.

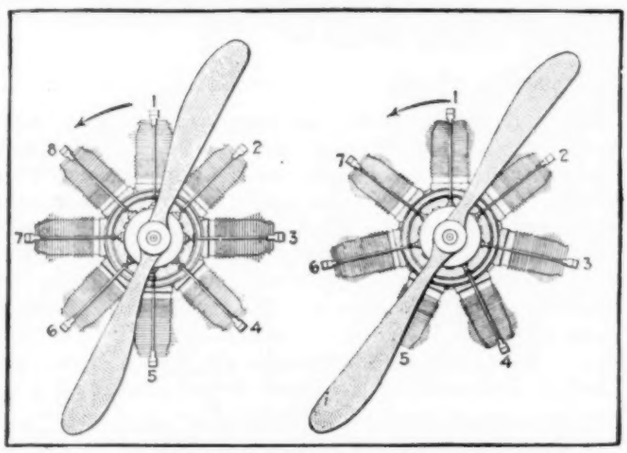
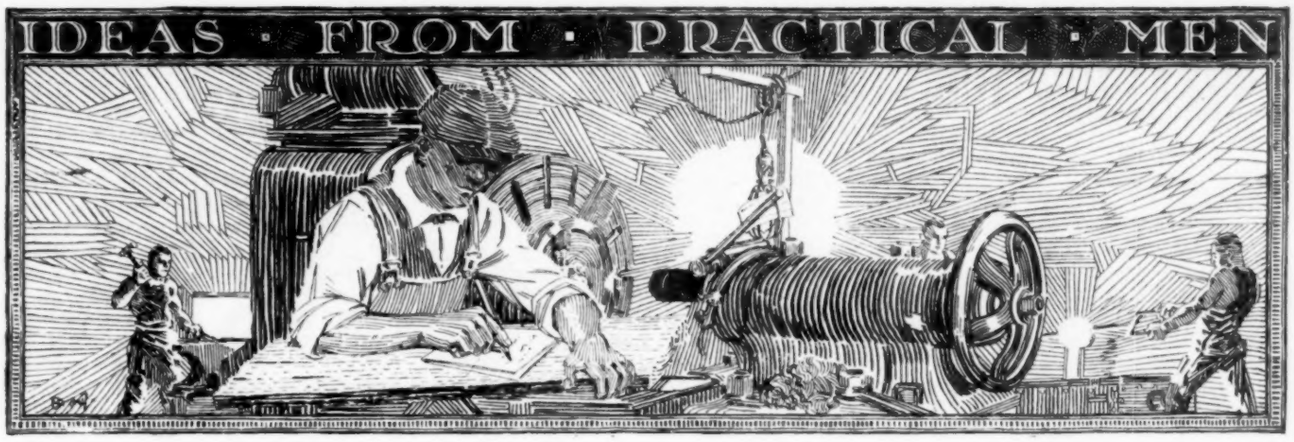


FIG. 5. DIAGRAM OF ROTARY-ENGINE CYLINDER ARRANGEMENTS

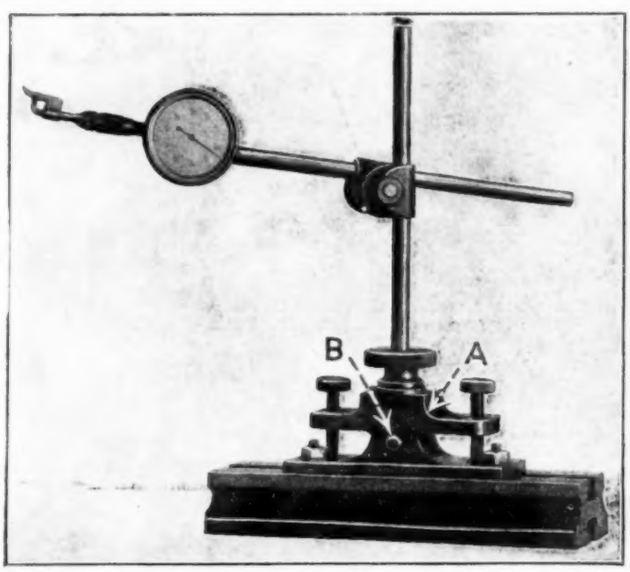
To close the discussion, a word about the rotary or revolving-cylinder engines should not be out of place. Engines of this type such as the Gnome, Le Rhone and Clerget, generally have the cylinders arranged radially in one plane about a drum-shaped crank case, all the parts being made of steel to secure the requisite strength. A brief study of Fig. 5 will show why they invariably have an odd number of cylinders, 5, 7, 9 or 11. The engines mentioned are all of the four-cycle type and turn counter-clockwise as viewed from the propeller side. The engine must make two complete revolutions to complete one cycle during which each cylinder fires once. If we try to work out the firing order for an even-cylindered engine, such as the eight shown diagrammatically in Fig. 5, we find that we must either fire all the cylinders during the first revolution and have them all dead during the second one, a manifest absurdity, or else fire them alternately, in which case there will be a break where the two series join. For example, if we fire 1-3-5-7-2-4-6-8-1- etc., we have 90-deg. firing angles between 1, 3, 5 and 7 and 2, 4, 6 and 8, but a 135-deg. angle between 7 and 2 and a 45-deg. angle between 8 and 1. There is no way out of the difficulty except to add or remove a cylinder, in which case we get a firing order of 1-3-5-7-9-2-4-6-8 all the intervals being the same, 80 deg. In the airplane engines in use, the cylinders are numbered as shown in Fig. 5, so that as the engine turns they pass top center in numerical order. This arrangement is the same on all engines of this type and gives a much easier firing order to remember and handle than any of the others.



A Home-Made Surface Gage

By Joseph Hagstrom

The illustration herewith shows a surface gage which I made to be used in connection with a dial indicator. The idea is not new but the tool embodies features which may be of interest to others because of its adaptability for use in positions where the regular form of gage might be inconvenient. A rocking plate *A* tilting upon the fulcrum *B* provides the movement and it is adjustable by means of the two fine-pitch, knurled-head screws near its ends. Other movements of the dial arm are common to all surfage gages.



HOME-MADE SURFACE GAGE

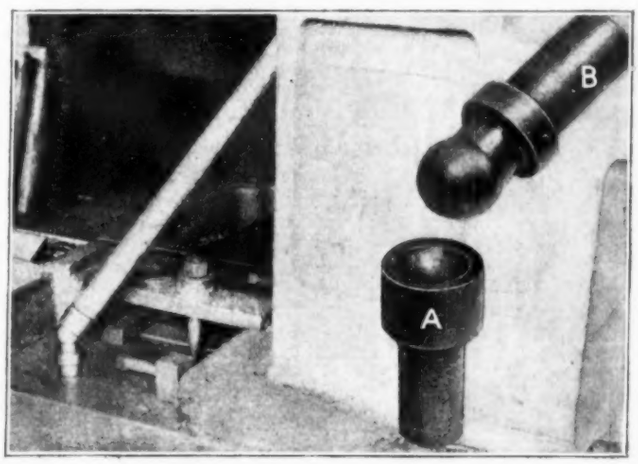
Bunters for High Work on the Planing Machine

By E. A. Dixie

Bunters for high work on the planing machine are often difficult to adjust properly because on long ones the operator cannot be at both ends at the same time. In the illustration is shown one of the most sensible ones that I have seen.

The ball member *A* has a stem that fits the reamed holes in the planing machine table. The socket *B* has a stem that fits the hole in ordinary wrought-iron pipe—in this case 1 in. When there is any high work to be supported against the force of the cut, the ball member is inserted in the table, a piece of pipe the correct length is cut off and the socket inserted in the one end of it. The other end is provided with a capscrew and nut to act as a jack. The ball and socket allows the strut to find its own location without constraint.

The device is shown at the left of the picture as it appears in place on a job. In this case the stem of the ball-ended member has been purposely allowed to project above the table so that it would show. When properly placed the flange comes in contact with the table.



BUNTER WITH BALL AND SOCKET

Enlarging an Automobile Piston

By John P. Wheeler

I have read with great interest C. M. Starr's description on page 548 of the *American Machinist* of how he enlarged an automobile piston, but why did he pound it with a sledge? If he had heated it just as he describes and then cooled it off without any hammering he would have found that it had enlarged or "grown" more than enough to make up for the 0.004 in. undersize. I once helped an old mechanic increase the size of a gas-engine piston, way back in 1892, which was a great deal more than 0.004 in. (or 0.04 in. for that matter) undersize. We heated and cooled it off three times, and then had to take nearly $\frac{1}{8}$ in. of a cut off it before it would enter the cylinder.

Of course we had to dress the ring grooves and make new rings, but that was quicker than getting out a new casting and machining a whole new piston.

STEALING JUICY TRADE-MARK PEACHES
YES BUT I GOT 'EM NOW WHAT WILL YOU GIVE ME
HEY ! THOSE BELONG TO ME
STERLING
ROYAL
WHITE
BLOCK
WOLF
ACME
STANDARD
WHITNEY
RED LEAD
INLAND
KELLOGG
OXFORD
HEINZE
American Machinist
Brow

What Have You Done to Protect Your Trade-Mark Abroad?

WE have several times called the attention of our readers to the fact that unless properly safeguarded, their trade-marks were liable to be stolen by unscrupulous persons in foreign fields.

A specific instance of the pirating of American trade-marks comes in a report furnished by the American Chamber of Commerce of Brazil, S. A. A single firm in Rio Janeiro has registered under its own name more than forty well known American trade-marks, the object being to make the real owner pay an exorbitant price for the use of what is actually his own property.

Out of the trade-marks, listed in the Diario Official, we give only a few that seem to be close to our field. These are "Kellogg" air pumps, Kellogg Mfg. Co., Rochester, N. Y.; "Heinze" dynamo and electric motors, J. O. Heinze, Springfield, Ohio; "Whitney" chains, Whitney Mfg. Co., Hartford, Conn.; "Hoyt" anti-friction metal, Hoyt Metal Co., St. Louis, Mo.; "Card" taps and dies, S. W. Card Manufacturing Co., Mansfield, Mass.; "Barnes" lathes, W. F. & John Barnes, Rockford, Ill.; "South Bend" lathes, South Bend Lathe Works, South Bend, Ind.; 'Edison" storage batteries, Edison Manufacturing Co., Orange, N. J.; "Evinrude" motors, Evinrude Motor Co., Milwaukee, Wis.

Apparently many exporters do not suspect the trouble in store for them, but once registered for the period required by law, a Latin-American trade-mark becomes the absolute property right of the registrant, and *infringement is punishable by fine, imprisonment and confiscation of goods.*

In Brazil, six months are allowed for protest dating from the time the notice is first published in the Diario Official.

From this it will be seen that prompt action is necessary if a manufacturer cares to protect his trade-mark in Brazil—but while he attends to this he should also attend to the proper protection of his trade-mark in other countries. In most cases the charge is small in comparison with the benefits derived.

Thos Viall

Needed Improvements in Our Patent Office and System

BY GLENN B. HARRIS
President, E. R. G. Company, Inc., New York

There is now before the Committee on Patents of the United States Senate, bill No. 11,984, which was referred to editorially on page 638. This bill vitally concerns our patent system and it deserves consideration and attention not only of every manufacturer of machine tools, but that of all manufacturers in this country as well. Here are the facts in the case.

IN 1848, the Patent Office was organized as a going body and in that year the position of Principal Examiner was considered of such importance that so far as his salary of $2,500 per annum was concerned, it was equal to that of a United States District Judge, and a Member of Congress. Except for a slight increase of $200, per annum, the salary remains as it was placed more than seventy years ago. The qualifications and duties of the Principal Examiner and his assistants will be referred to later.

The bill now before Congress bearing on the efficiency of our patent system, and the organization of our Patent Office, so far as this pertains to the effective handling of the work, is briefly, to increase the force and salaries in the Patent Office. There is also a provision which is intended to extend means for arriving at or compensating damages in infringement suits where the plaintiff is successful. What, however, concerns the machine tool industry most vitally is the obtaining of and retention in the patent office of a competent examining corps. This is absolutely essential to the safeguarding of the best interests of the machine tool industry, and can only be obtained by paying this corps salaries adequate with the services which they render.

The duties of an examiner are of an extremely technical or scientific nature, in addition to which a knowledge of law is most essential, particularly patent law in order that the rulings of the Commissioner of Patents, the Examiners in Chief and the Examiners of Interference may be intelligently interpreted as to procedure. The decisions of the Courts as to what constitutes patentable subject matter must also be properly interpreted. On an application for patent reaching the Examiner's hands it must be carefully gone over for the detection of any language errors. The specification must then be checked with the drawings to determine that the references thereto by letter or numeral are correct and also that the drawings illustrate an operative device or mechanism, and are in thorough accord with the specification or description. Even this apparently simple procedure requires more than ordinary ability. When this examination of the invention as covered by the specifications is completed and claims of the application for patent has been made, the examination as to the patentability of the invention and the scope of the claims is taken into consideration. This examination, if thoroughly carried out, is one requiring an ability to read mechanical drawings almost at sight, and also a keen sense of discrimination as to whether an apparently pertinent reference, that is a previously granted patent or publication, is applicable to the subject matter under examination or any part thereof, or the claims thereunder, which may be involved in the application. It also calls for a thorough search through arts analagous to that of the applied-for patent.

In our editorial on page 638 we advised our readers that Patent bill No. 11,984 had passed the House and was before the Senate. This bill should not be delayed as the situation regarding competent help in the Patent Office is critical. Mr. Harris has personally gone over the conditions in Washington within the last few weeks, and knows what he is talking about.

The duties of the position are of a trying and exacting character, and such as merit very material increases in salaries. At the present time there are many vacancies in the Examing Corps of the Patent Office due to the fact that the salary at entrance, fifteen hundred dollars, is not sufficiently large to attract the character and quality of men who are able to pass the rigid examinations laid down by the Civil Service as a prerequisite to appointment to Examiners' positions. In consequence temporary appointments and transfers of clerical help are necessitated by existing conditions, and the character of work rendered is of a decidedly inferior character. Even though this temporary help may gain knowledge during its incumbency, there is no way at present by which their services may be permanently retained as they are not sufficiently educated to pass the examinations.

The Commissioner of Patents is authority for the statement that the work of the Patent Office was never in such a poor condition, that he has eighty-five fourth assistant examiners' positions, and that men will not take them even without examination at the present alary.

Before the war it was possible to obtain good men through the Civil Service notwithstanding the low salaries and rigid requirements, but this is now a thing of the past and to add to the difficulties which the Patent Office is encountering it is losing approximately twenty-five per cent of its entire examining

force each year through resignation. There is a tremendous demand for scientifically trained men just at the present time and the examiners will not remain in the office at the salaries which are now being paid.

To give any idea as to the exacting requirements, reference is made to a circular issued by the Civil Service Commission on which it is stated that an examination to fill vacancies in the examining corps of the United States Patent Office will be held on a given date, and that competitors will be examined on subjects which will have the relative weights indicated.

DIFFICULT EXAMINATIONS

1. French or German	20
2. Mechanical drawing	20
3. Technics covering the field of mechanics, mechanical arts, industrial arts and processes and applied chemistry	20

The above examination extends over a period of two days, and on the third day the applicant must select two subjects from Chemistry, Civil Engineering, Electrical Engineering, Mathematics, Mechanical Engineering, Physics and Experience, and to each of these subjects a rating of 20 is given.

The percentage required for a passage of the examination is relatively small, seventy per cent, but when its exacting character is taken into consideration even this percentage is high. If the applicant is a young man fresh from college he is naturally lacking in experience, and would fail on this phase of the examination. Should the applicant possess experience it would have been gained by hard work in some manufacturing industry, and the position offered would not be an appealing one, for with the educational requirements necessary plus experience there would be literally thousands of positions open at salaries much more than double those offered.

The manufacturing industries of the country are constantly on the look out at graduating time for the product of our colleges and our technical schools which turn out young men with technical or scientific educations, and offer them salaries and inducements far beyond the possibilities offered in the examining corps of the Patent Office. Salaries of $2,000 to $2,400 and upward are the initial offering. How then is the government in a position to secure the high grade services required at the rates offered?

To return to the examination which an applicant for the position of Assistant Examiner is compelled to pass, reference is made to some of the questions submitted in a typical examination.

TECHNICS

Manufacture of porcelain, steps in process.

Production of zinc oxide (a) American process, (b) French process, (c) in manufacture of vulcanized rubber.

What are the uses of tungsten, chronium, nickel, ferro-silicon, and ferro-manganese in metallurgy? Give chemical and physical effects of each.

Describe a shrapnel shell ready for use.

Describe a 5 Kilowatt Radio set ready for use.

Give methods, sketch, and diagram electrical production of nitrates from the atmosphere.

These are a few of the questions propounded under the head of Technics, but wait—under the head of physics we have such very simple little queries as:

"Cubic sheet of metal 100 sq.cm., 6 mm. thick is exposed to a temperature of 100° C, on one side and 0°C on the other. Find the time traversing the plate. —Sp. cond. of Cu. 713.

$$\frac{713 \times 100 \times 1 \times 100}{0.06}$$

State five types of simple machines, define mechanical advantage, define efficiency of machine.

Describe fully the principles of the gyroscope, explain its precision, give two distinct examples of gyroscopic action. Explain radio activity, also the X-Ray.

Under the head of Chemistry we have the following:

Describe the preparation of chloroform, giving the chemical reactions by formulas.

Describe the manufacture of glucose (by formulas).

Give complete description of the manufacture of Fe.

Where are the principal deposits of sodium nitrate found, for what is it used and what is its commercial industrial value in the arts?

In addition to what has been outlined there is an examination on the ability of the applicant to read understandingly various sheets of mechanical drawings and he is required to thoroughly dissect the same, describing the views, the construction of the machines and their operation.

The requirements as before set forth are examples of the comparatively simple ones in which the applicant for the lowest position in the Patent Office Examining Corps must prove himself competent.

OTHER EXAMINATIONS COMPARED

Having touched only a few of the high spots in the examination of a prospective fourth assistant examiner in the Patent Office it might be well to give briefly a synopsis of other examinations for admittance to the government service.

The position of Special Agent, Bureau of Foreign and Domestic Commerce, pays $3,650 per annum, or $950 more per year than is given a Principal Examiner in the Patent Office.

Education and experience	40
Language, say Spanish	20
Practical questions aiming to bring out the candidate's knowledge of the subject in connection with which he is an applicant	40

Then we have an examination for the position of Chief of Division of District Offices, Bureau of Foreign and Domestic Commerce. The entrance salary is $2,500, and the examination is only briefly referred to as:

Education (the equivalent of a four-year high school course)	20
Experience	50
Thesis	30

A principal examiner receiving $2,700 per year, and reaching this position by showing himself to be a star in the four successive grades of assistant examiner, is in charge of a number of assistant examiners and a very considerable office and only reaches this position through years of untiring devotion to duty and proven ability. He must have an intimate knowledge of mechanics, the sciences and the arts, and must also not only be well grounded in the law, but must keep absolutely abreast the times regarding decisions of

the different tribunals which have the deciding of patent questions.

It is thought that a large majority of our readers will reach the immediate decision that there is no comparison between the exacting requirements placed on a Principal Examiner and those to which brief reference has been made, but that there will be a practical unanminity of opinion that the Patent Office Examiner is a laborer worthy of his hire, and that he does not get it.

There is one little feature in an examiner's work to which attention is asked, and that is a dissection of the following equation from a dye patent. The reaction is set out in the following equation:

$$C_6H_4\begin{cases}N(CH_3)_3X\\ N=N\end{cases}C_6H_2\begin{cases}CH_3\\ N=NCl\end{cases} + C_{10}H_{10}N_2O = \text{Phenylmethylpyrazolon}$$

$$C_6H_4\begin{cases}N(CH_3)_3X\\ N=N\end{cases}C_6H_3\begin{cases}CH_3\\ N=N\end{cases}C_{10}H_9N_2O + HCl$$

X in this equation means chlorin or an equivalent radical of an acid.

The claim in the dye patent reads as follows: "As a new product, the yellow dyestuff obtained from diazotized metatrimethyl ammonium phenyl-azo-meta-toluidin and 1 phenyl 3 methyl 5 pyrazolon, being an orange-yellow powder, soluble in water, alcohol, ether and benzene; insoluble in petroleum ether, dyeing tanned and untanned cotton as well as half wool yellow in an acid bath, substantially as set forth."

It will undoubtedly be appreciated that it requires a scientist who must also have a thorough legal training to interpret and construe this patent.

Office Staff Depleted

The Commissioner of Patents has stated that he is losing about twenty-five per cent of his examiners yearly. There is no business concern that can survive under such a turn-over and this holds good particularly with the Examining Corps of the Patent Office where, notwithstanding the high grade of men obtained, a period of training of at least two years in the office is essential to make the new man at all proficient, and this proficiency is attained at the expense of time on the part of his superiors in giving instructions, advice and in thoroughly checking up the work of the novice.

The reason for the wholesale resignations from the Patent Office is not hard to locate. Large industrial concerns maintain their own patent staffs and are ever on the lookout to secure the services of the cream of the Patent Office force.

In addition the Patent Lawyers are continually depleting the office by offering partnerships or positions in their offices and the inducements are such that the Examiners cannot consistently refrain from accepting the proffers made them.

As an instance of the earnings of Examiners in and out of the Office reference is had to resignations occuring during a period of two months of 1919. There were resignations of three principal examiners in the time mentioned. These examiners were drawing $2,700 per annum. In their new positions the average earning was $4,500. Five second assistant examiners resigned positions paying $2,100 per annum, to accept outside positions bringing an average income of $2,920 per year, while two third assistant examiners left government service at $1,800 to accept incomes of $2,500 per annum.

In the British Patent Office where the requirements are not in the least comparable with those of our own office, the salary of the official corresponding with our Commissoiner of Patents, is $7,305 compared with our $5,000; our chief clerk receives $3,000, in Great Britain $4,866. Supervising examiners receive in Great Britain, $3,896, here the corresponding positions are recompensed $2,700. The first grade examiners receive from the English Patent Office $3,409, here $2,400 and in the next lower grade $3,287, as against our $2,100. A noted inventor in hearings held by the Committee on Patents testified that in *one* of his cases the fees paid his patent lawyers amounted to approximately $10,000, while the examiner who made the search under his application, passed on its form, correctness of statement and the patentability of the subject matter submitted, received but $2,700 per year and the application for the patent referred to was only one of hundreds that came to him for consideration and decision during the year.

Salaries in Other Departments

The Patent Office is to the manufacturing industries of the country what the Agricultural Department is to the agricultural interests. In this latter department of the government there are in the neighborhood of forty skilled employees who obtain salaries of from four to six thousand dollars per year, the latter salary greater than that of the Commissioner of Patents and the lower figure nearly equal to that of the Assistant Commissioner of Patents and greatly in excess of that of other officials in a lower capacity. In other words there are but two more than $4,000 per annum, and yet the requisite qualifications of these most estimable and learned men in the Agricultural Department are not nearly as exacting as are those for the position of Assistant Patent Examiner.

The Agricultural Department receives from the government more than $30,000,000 per year and this amount is practically all expenditures with no monetary return.

The Bureau of Standards which was established about twelve years ago, and which is an admirable, helpful, and it might be said necessary institution, but which is not to be compared in importance to the Patent Office, receives practically as much for its maintenance as does the latter and with this Bureau it is practically all expenses and no income.

Assistant physicists in this branch of the government receive $2,800 per year and more, while the heads of sections receive considerably larger sums, all greatly in advance of the salaries paid Patent Office Examiners. The importance of the duties, their responsibilities and their exactions in the two different offices are not comparable, but were they, the advantage would strongly resolve itself in favor of the Patent Examiner.

The War Department has announced that it has been successful in obtaining the sum of $2,000,000 for army schools. There is no one who will criticise this appropriation, but why should not the Patent Office be as generously treated.

The Patent Office is much more than self sustain-

ing and now has accumulated in the U. S. Treasury more than $8,000,000. This surplus is yearly increasing, and yet no part of it can be utilized for the betterment of Patent Office conditions.

The inventors of the country and the manufacturers who aid them, pay for a service which is but inadequately rendered, and there is no substantial reason why this branch of the service should not give a prompt and efficient return for that for which it has been paid. It is absolutely beyond the pale of excuse.

Applications for letters-patent are increasing in large number, and even with the force maintained at its present level, that is to say were there no resignations, the present complement of examiners, clerks and others would be entirely incapable of contending with the present, not taking into consideration the ever increasing volume of work. At the present time there are applications for patents on file which have been pending nearly eleven months and yet have not been reached for preliminary action. The division which is nearest up-to-date in examination is two months behind in its work. Fifty per cent of the divisions are eight months or more in reaching their work.

This, however, is not all. A case when examined is probably in nine cases out of ten (this is extremely conservative) found anticipated in whole or in part by something that has gone before. This necessitates a rejection of the application in its presented form and requires amendment on the part of the applicant's attorney. This procedure takes place by correspondence and is not at all similar to cases in court where the evidence of the plaintiff is heard and then that of the defendant and a decision reached.

The delays in the prosecution of a case through the Patent Office are not only disheartening, but to many of incalculable detriment and injury. As the time consumed in obtaining a patent requires from two to three years in cases that are not at all unusual. It needs no argument to convince those at present interested in patents or who are likely to be at some future time, and all of the readers of the *American Machinist*, of the imperative necessity of doing all within their their power to aid in securing an adequate force in the Patent Office to care for as promptly as possible the applications for patents which are presented, and to retain an efficient personnel that this may be an accomplished fact.

The filing of an application for patent affords no protection whatever. Protection can only come when the patent is issued, when it is an assured fact. It is true that should a conflicting application be filed, that is an application on substantially the same device, the two or more parties claiming the invention must pass through interference proceedings which are initiated to decide which of two or more inventors is rightfully entitled to the invention in question. These proceedings are not only long drawn out but are expensive beyond the means of the average inventor.

The delay in reaching applications for patent and examination as to patentability is very apt to plunge the rightful applicant into these interference proceedings. If the subject matter of the invention is placed on the market, chances are taken and must necessarily be taken that the unscrupulous will take advantage of the fact that the patent has not been granted thereon, and will begin manufacture of the invention. The owner has no recourse whatever until the patent issues. In numerous instances a conflicting application for patent is filed covering a meritorious invention with the sole purpose in view of delaying the issuance of a patent. The party filing this illegitimate application does so for the sole purpose of delaying the grant to another of that which rightfully belongs to him and thereby enabling the usurper if only for a few years to obtain gains to which he is not rightfully entitled.

It would therefore seem that for the proper performance of the legal and technical duties incident to the investigation and determination of the problems and questions involved in the work of patent examiners it is essential that such officials be long trained in not only the metaphysical but the judicial consideration of the scientific, technical and legal questions presented, and yet none of the interests so vitally concerned in the patent situation have sought to furnish means to provide for the retention of competent patent examiners by improving working conditions, or seeking to raise grossly inadequate salaries. As a result it is practically impossible to retain the valuable services of experienced examiners or to obtain the services of efficient new examiners, so that the interests of inventors, manufacturers and investors in patent property have been most seriously impaired.

It is a fact that a serious industrial condition exists in the Patent Office. A condition calling for aid rather than for criticism or reflection, and this condition must be met and remedied if inventors are to be expected to continue to produce new forms of industrial property in the public interest, if capital is to be expected to invest in industrial enterprises and if the ever increasing demands which it is continually making for increased conveniences, and everyday necessities, are to be met.

It is urged that the serious condition in the Patent Office can only be counteracted by enlarging and modernizing it, by giving it the required personnel, and proper facilities and equipment.

Who's Next?

At Chicago, on March 16, the American Railway Engineering Association adopted the following resolution which was introduced by W. H. Courtenay of the L. & N. R.R.:

"The American Railway Engineering Association, in convention assembled, expresses its opposition to the adoption of the metric system of weights and measures to the exclusion of the English system or the American system at present in general use."

It may be stated without fear of contradiction that since the inauguration of the patent system, the Patent Office has constituted the greatest primary governmental medium in producing the industrial wealth of the nation. It is not a question of whether the patent system, or the Patent Office, will be self sustaining under the proposed increase, and yet it is positively assured that it will be and with a surplus of from two to three hundred thousand dollars annually. But the question of self-support should not be the controlling factor.

If funds can be appropriated to the extent of thirty million dollars or more to promote the Department of Agriculture which is engaged in promoting agricultural interests alone, and which is not in any way self sustaining, certainly two or three million dollars may be readily appropriated to maintain a modernized and self supporting Patent Office which will be engaged in promoting all lines of industry, including the agricultural interests

Salient Features of the Bill

In the patent bill H. R. 11,984, before referred to, and which passed the House of Representatives by a vote of 272 to 6, there is also embodied a section which deals with the question of damages in infringment suits and in order that this feature of the bill may be understood by manufacturers and others interested in patents, its salient features are given as follows:

"The several courts vested with jurisdiction of cases arising under the patent laws shall have power to grant injunctions according to the course and principles of courts of Equity, to prevent the violation of any right secured by patent, on such terms as the court may deem reasonable; and upon a decree being rendered in any such case for an infringement the complainant shall be entitled to recover, in addition to the profits to be accounted for by the defendant, the damages the complainant has sustained thereby, and the court shall assess the same or cause the same to be assessed under its direction. If on the proofs it shall appear that the complainant has suffered damage from the infringement or that the defendant has realized profits therefrom to which the complainant is justly entitled but that such damages and profits are not susceptible of exact calculation and determination, the court may on evidence tending to establish the same, in its discretion, receive opinion or expert testinmony, which is hereby declared to be competent and admissible, subject to the general rules of evidence and all other evidence applicable to this character of testimony and upon such evidence and all other evidence in the records, the court may adjudge and decree the payment by the defendant to the complainant of a reasonable sum as a royalty or general damages for the infringement, and the court shall have the same power to increase such damages in its discretion as is given to increase the damages found by verdicts in actions in the nature of actions of tresspass upon the case; but in any suit or action brought for the infringement of any patent there shall be no recovery for profits or damages for any infringement committed more than six years before the filing of the bill of complaint or the issuing of the writ in such action, and this provision shall apply to existing causes of action."

With regard to this proposed change in the statutes governing compensation for the infringement of patents the following will undoubtedly prove of interest to the manufacturer:

While an injunction can ordinarily be obtained against an infringer in a case where a patent is adjudged valid, except where it would interfere with Government work, a monetary recovery has not heretofore been generally possible except under most favorable circumstances. In a case where it cannot be said that the entire salibility of the article depends upon the invention it has been necessary to show just how much of the price of the article is attributable to the invention, and as it is ordinarily impossible to make such a separation, and as most patent cases are ones in which it cannot be said that the whole salability of the article depended upon the invention, it has resulted that recovery of money is seldom obtained in a patent suit.

Courts Take Liberal Attitude

Recently there have been two or three decisions in which the courts have taken a more liberal attitude, holding in effect that where an invention has been used by the infringer a reasonable royalty may be awarded to the patentee based on a mere estimation or on opinion evidence, even though no exact computation can be made. This is analogous to the attitude of the courts in personal-injury cases and is entirely just and reasonable. While, as stated, there have been two or three decisions to this effect, it may take a generation to induce United States courts generally to adopt this position, if at all, and the committee therefore proposes that the law be amended to provide, that as damages to the complainant, the court, on due proceedings had, may adjudge and decree to the owner payment of a reasonable royalty or other form of general damages. Such an amendment has been provided in the attached bill amending section 4,921, the Revised Statutes of the United States, and reading as follows:

"If proof is not offered or, in the absence of adequate proof of the amount that should be awarded as damages or profits, the court on due proceedings had, may adjudge and decree to the owner payment of a reasonable royalty or other form of general damages."

This proposed amendment would enable the patentee in all suits where the patent has been found valid and infringed to recover at least a reasonable royalty, and would provide a money recovery in the great majority of patent suits where no recovery would otherwise be possible. It is believed that the comparative certainty of financial return would answer one of the most common and strongest reproaches against the patent system, namely—that a patent does not ordinarily pay the inventor any money, and it believes that the incentive to invent would accordingly be greatly increased. There are some cases in which it seems to many who are familiar with such matters as though the courts were inclined to go to the other extreme and award damages out of all proportion. Where a complainant has shown that profits have been made by the use of an article patented as an entirety, the infringer is liable for all the profits unless he can show—and the burden of proof is on him to show—that a portion of them is a result of some other invention used by him. If the infringer can not show what proportion of the profits is due to such other invention, then all

his profits must go to the complainant. Any rule by which the entire profits are given to a patentee in the absence of proof that they are all due to the invention of the patent sued upon is unfortunate and sometimes very unjust. The proposed amendment to the statute would permit a court under these circumstances to do substanial justice, even though it could not be mathematically exact.

Use of Photostats in Plant Layouts

BY THOS. H. WESTPHAL

For placing machinery in a new or remodeled shop or for rearrangement in an existing one, the use of cut-out scale plans of the machines is common, but it is sometimes rather tedious work to make these plans to the required scale with the necessary amount of detail. For this purpose photostatic reductions from the manufacturer's drawings of the machines may be quickly made to any desired scale and cut out in outline as at *B* in Fig. 1, which represents the silhouette plan of the air compressor of which the locating dimensions are given in the maker's blueprint *A*.

In Fig. 2 the floor plan of the shop appears with the available space marked roughly in crayon. In Fig. 3 the two cut-outs are shown in position on the floor plan.

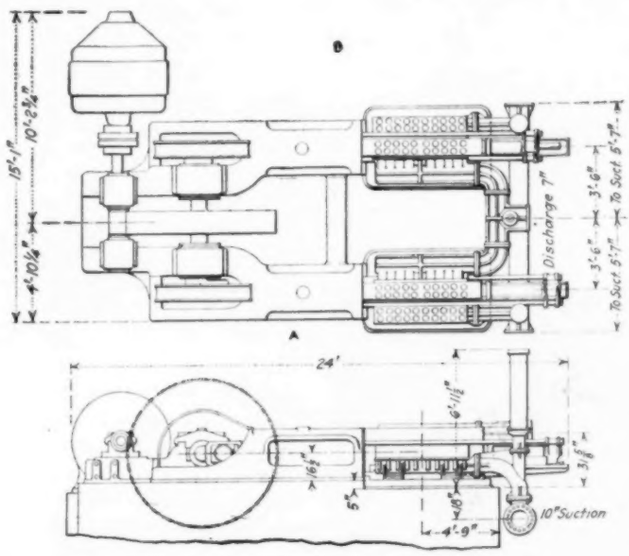


FIG. 1. PLAN OF COMPRESSOR

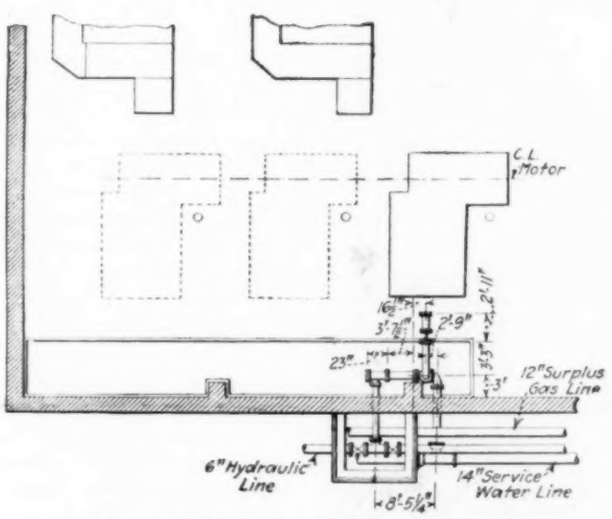


FIG. 2. FLOOR PLAN OF SECTION OF SHOP

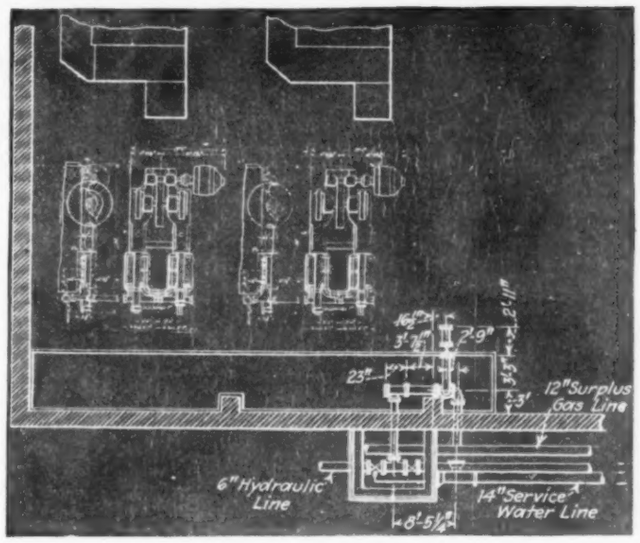


FIG. 3. PHOTOSTAT PLAN IN POSITION ON FLOOR

A Home-Made Boring-Tool Holder

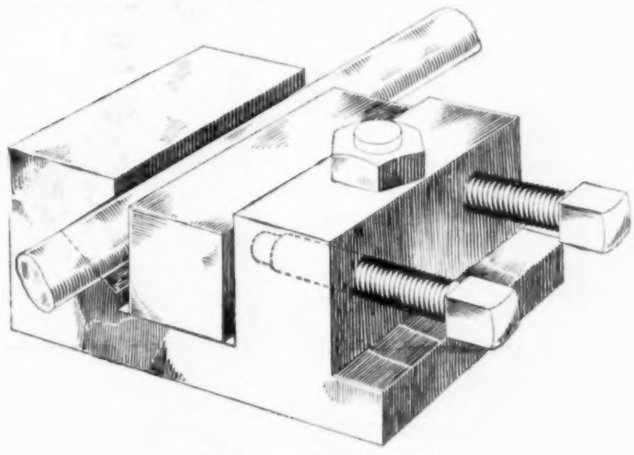
BY J. A. NIGHTINGALE

The illustration shows a boring-tool holder that may be of interest. It is rigid and at the same time adaptable. It is preferred by lathe men here to the commercial article or to other home-made devices.

The holder is of cast iron, machined flat on the bottom, and has a V-shaped groove in the raised portion, with the apex of the V on the center line of the lathe. It is held to the cross-slide by a single heavy bolt with a head made to fit the T-slot, and a nut that fits the tailstock wrench.

The boring bars are clamped into the V with two hardened screws having heads to fit the toolpost wrench. These screws bear directly on the largest boring bars, while in using the smaller ones a piece of square bar stock is dropped in between the screws and the bar.

This saves time, as by loosening the clamping screws the block can be lifted out and the bar removed instead of backing the screws out far enough to clear the bar. This device holds, both firmly and on center, anything from a big bar for boring engine cylinders to a tiny bar the size of a match.



BORING-TOOL HOLDER

WHAT to READ —for the man in a hurry

Suggested by the Managing Editor

Nobody who is holding down a man's job has time to read all of the American Machinist. On the other hand there are some articles in every number that you can't afford to miss. We are running this page to save your time by pointing out the articles in this issue that are aimed at men holding jobs like yours. Read the editorials—they are short and to the point. The "Sparks" will give you the latest news of the machine industry. The "Shop Equipment News" columns show the innovations in tools and methods.

MASON Britton told us just as we were about to start this week's page, that nearly one-quarter of several hundred print shops were losing money. And they were losing it simply because they had no notion of proper cost keeping. He went on to say that it had set him to wondering how many machine shops were in the same fix.

We want to say right here that it is against our principles to let any member of the business management get his name into the editorial section, but this is an exceptional case. For, this time, we were able to stick our thumbs in our vest, tilt back our chair, and say with a condescending smile, "Look at the leader in the April 8 issue."

This leader is the first installment of a long series we have been working on for several months. The idea was to present to machine-shop owners and operators a series of articles by an acknowledged authority that would be equally useful to all sorts of shops and that could be filed as a reference book on the subject of factory management.

We have called it "Modern Production Methods" for want of a better title. It covers so much ground that it is hard to be more specific. The author, whose photograph appears in the middle of this page, is W. R. Bassett, president of the firm of Miller, Franklin, Basset and Co., of New York City. This organization tackles problems of any sort that may come up in any manufacturing plant, from the design of the plant to marketing the product. Mr. Basset does not believe in the use of formulas but in judging each case on its merits, and prescribing a remedy on that basis. He writes this series for the machine shop as a result of his experience of eighteen years in more than 1,500 factories.

For the designers and draftsmen we have two articles worth noting. Professor Furman's tenth article on Cam Design begins on page 777 and takes up the details of the effect of variable angular velocity of the drive shaft on the design of the toe and wiper cam and also goes into the matter of friction in this combination. Then there is an article on page 773 dealing with the proper treatment of studs in machine parts. We also have a good one for the toolmakers. It is by Pusep, one of our older contributors, and deals with the lapping of small cylindrical plugs and the measurement and gaging of the completed work.

If you don't like to laugh don't read Glenn Quharity's latest "Pipe Dream," page 775. It hasn't very much connection with machine shops or machine tools, but that doesn't make it any the less funny.

SHOP EQUIPMENT NEWS

-Edited by-
E. L. DUNN and S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and • equipment •

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs • and equipment •

Cutler-Hammer Self-Starter for Slip-Ring Motors

The Cutler-Hammer Manufacturing Co., of Milwaukee, Wis., has developed an automatic starter with a speed regulating handle for use with slip-ring motors engaged in driving printing, folding and paper box making machines, etc., where a high torque is frequently required for starting and some speed changes are desired.

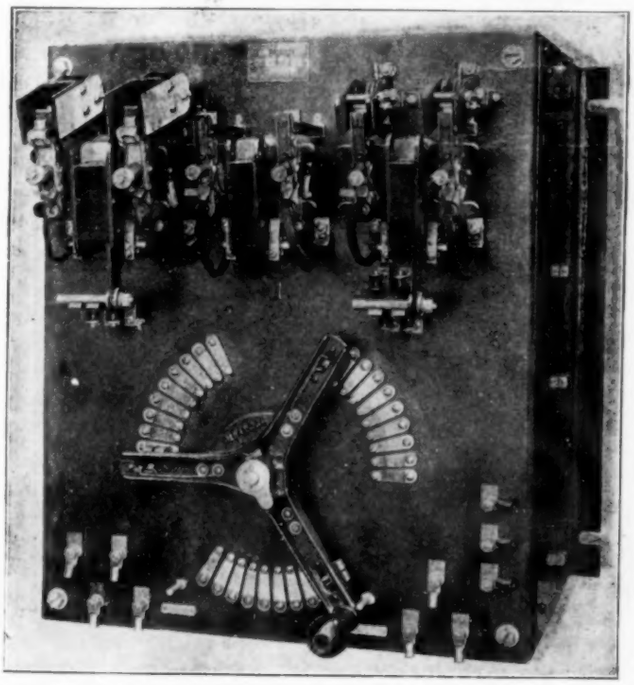
The starting panel consists of a primary and two secondary double-pole-magnet switches, below which is mounted a rheostat consisting of the resistance segments and sliding contact arms for regulating the resistance in the secondary circuit. As the handle of the rheostat is moved, resistance is cut in or cut out of each of the three phases.

The starter is operated from one or more push button stations with three-wire control. A special type of reversing push-button master switch can be provided with the controller for use with cylinder presses. Upon pressing the "run" button the main contactor closes, and the torque resistance is automatically inserted by one of the secondary contactors. When the motor has attained its speed the other contactor closes and cuts out the starting resistor and inserts the speed-regulating resistor. The motor automatically comes to the speed for which the regulating resistor is set. Speed regulation may be made while the motor is running by manually operating the regulating rheostat, which is of sufficient ohmic capacity to allow approximately 50 per cent speed reduction at one-half the rated load of the motor. Low voltage protection is an inherent feature of the equipment.

Both the starting and regulating resistors are mounted to the rear of the panel in a sheet iron frame which is arranged to be mounted on a wall or switchboard by means of four bolts.

When the panel is installed in an exposed position so as to be dangerous to workmen, it may be provided with a sheet metal enclosing case, with the speed reglulating lever outside.

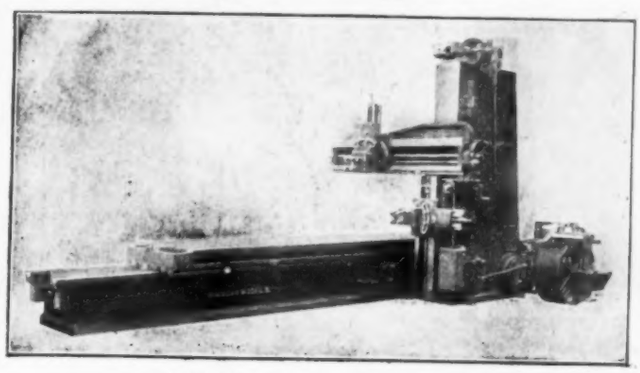
This new controller is made in various capacities up to 15 hp. for use on the several commercial voltages not exceeding 550.



CUTLER-HAMMER SELF-STARTER FOR SLIP-RING MOTORS

Simmons Openside Planer

The Simmons Machine Co., Inc., Albany, N. Y., is manufacturing openside planing machines of the design illustrated. The model shown will plane work 42 in. wide, 48 in. high under cross-rail, and 12 ft. long. The machine is heavily built, the bed being of box section with a solid top and provided with full depth inside ribs. The table is of the double-deck pattern and has three planed T-slots, the center one extending to the extreme ends of the table. The heavy, box-type column is reinforced with inside ribs, is tongued and grooved to a cheek piece on this bed to which it is securely bolted with turned bolts fitted to reamed holes. The L-shaped cross-rail is reinforced to resist strains and has a long bearing on the column. It is amply braced

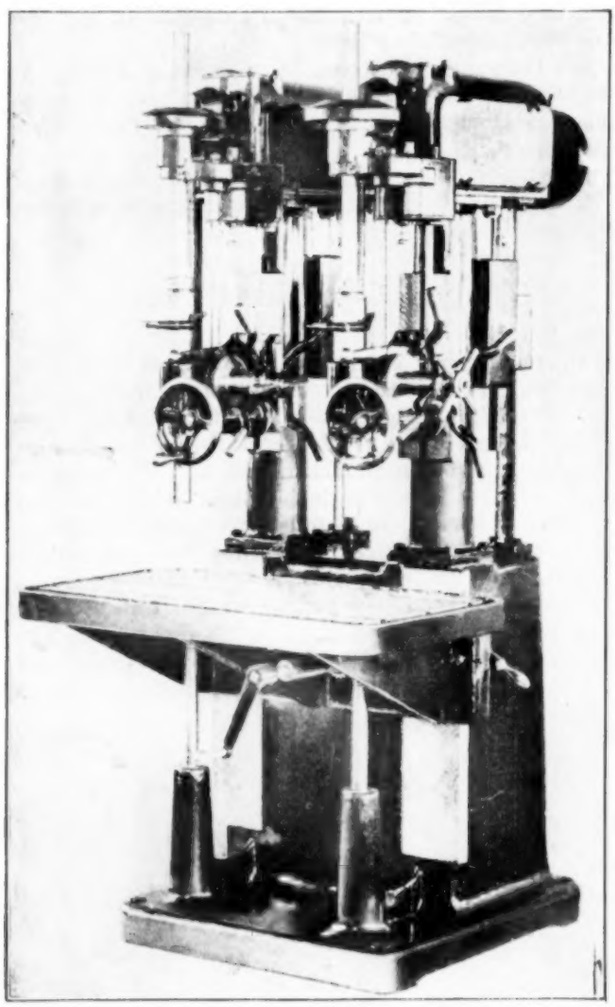


SIMMONS OPENSIDE PLANER

at the back and is raised and lowered by power. The cross-rail head has horizontal, vertical and angular feeds which are positive in action and may be adjusted without stopping the machine. A spiral-gear drive is used, the cast-iron rack and steel pinion being cut from the solid. The drive-shaft bearings are bronze bushed and provided with oil cups; the end thrust may be taken up by a key located at the outside of the bed. The belt shifter can be operated from either side of the machine and may be locked in the off position to prevent accidental starting. The rocker arm is provided with a trip lever, which allows the table to be run past the shipper dogs for the purpose of inspecting the work.

Dauber-Kratsch "Wisconsin" Gang Drilling Machine

The Dauber-Kratsch Co., Oshkosh, Wis., has added the all-geared gang-drilling machine, shown in the illustration, to their line of "Wisconsin" drilling machines. The upper structure of these is similar to their gear-driven 20-in. drilling machines, but the base is designed so that they can be built up in units of two or more spindles. At the present time these are made up as two-, three- and four-spindle machines.



DAUBER-KRATSCH "WISCONSIN" GANG DRILLING MACHINE

Specifications: Drills to center of circle, 20¼ in.; spindle movement, 8 in.; movement of sliding head, 7 in.; diameter of spindle, 1¼ in.; Morse-taper hole in spindle, No. 4.

A wide work table is provided and this rests on broad-faced planed and scraped ways. The table may be locked in position by a lever-operated gib. There is an elevating screw directly beneath each spindle, and these are operated simultaneously by a single crank.

A heavy column construction is employed which is reinforced by a straight back-strut which both supports the rear end of the gear box and relieves the column of bending stresses induced by drilling pressure.

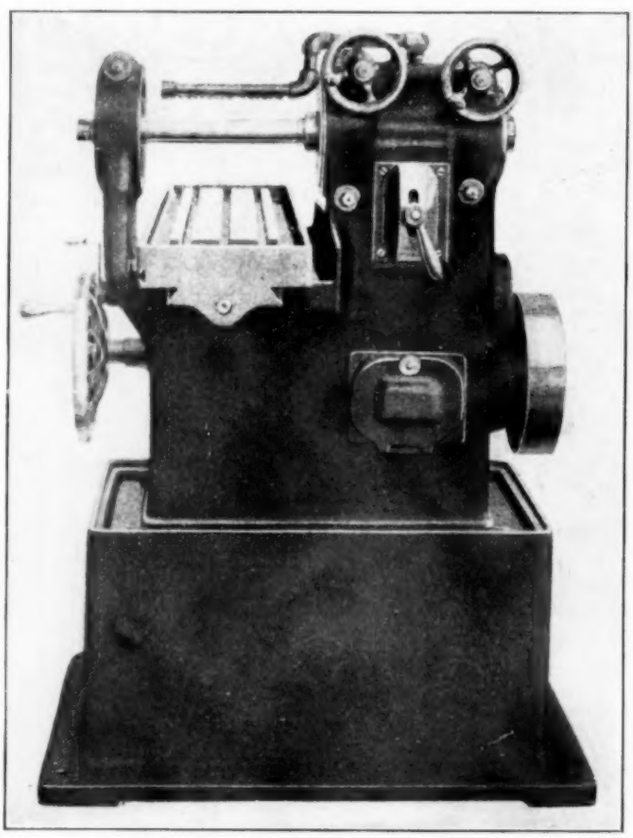
A single-pulley drive is used, and by suitable gearing the power is transmitted from one spindle-gear box to the next. The drive consists of semi-steel and rawhide gears which are engaged or disengaged through friction clutches by means of a single operating lever.

The machine is equipped with a sliding head and geared power feed. It has a hand feed and a large pilot wheel for quick return of the spindle and for sensitive drilling with small drills. There are four changes of feed for each spindle speed. If desired, a two-speed friction countershaft may be furnished, thus giving eight spindle speeds. The machine may be equipped with a tapping attachment if desired.

The Gabrielson Milling Machine

The Gabrielson Manufacturing Corporation, Syracuse, N. Y., has brought out the milling machine illustrated herewith.

This machine was designed solely for manufacturing operations. The arbor support is an integral part of the frame, avoiding the necessity for an overarm. The frame, which houses all the gears and working parts



GABRIELSON MILLING MACHINE

Specifications: Taper hole in spindle, No. 11 B. & S. Spindle adjustment: vertical, 1 in.; endwise, ½-in. Drive pulley: size, 14 in. in diameter for 3½-in. belt; speed, 320 r.p.m. Table: working surface, 34 x 7 in.; travel, 31 in.

is cast in one piece and is bolted to a base containing a reservoir for cutting compound. The base is larger than the frame and has a raised edge to catch all drip.

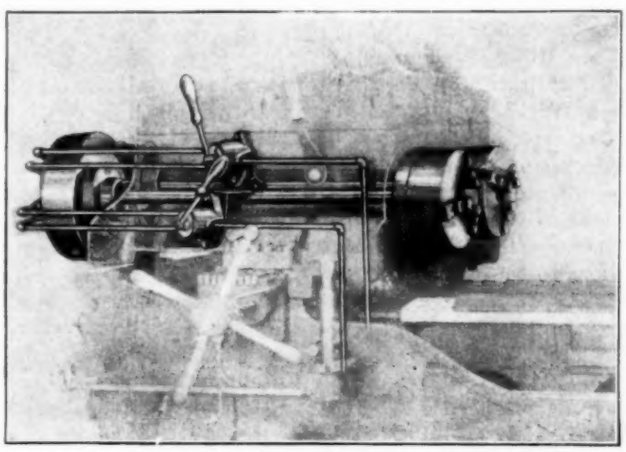
The spindle is hardened, ground and lapped and runs in bronze bearings, having means of adjustment for wear. Both spindle and bearings are carried in an eccentric sleeve which provides for vertical and endwise adjustment.

The constant speed drive is through a pulley and gears mounted on ball bearings. Changes in speeds and feeds are effected by change gears.

This machine is built in three sizes having distances between spindle and table of 6, 9 and 12 in. respectively.

Logan Air Chucks for J. & L. Double-Spindle Turret Lathes

The Frank G. Payson Co., 9 South Clinton St., Chicago, Ill., has developed a special line of air-operated chucking equipment for service on Jones & Lamson double-spindle flat-turret lathes. The illustration shows the method of installing this equipment,



LOGAN AIR CHUCKS IN J. & L. DOUBLE-SPINDLE TURRET LATHE

the chuck and air cylinder being connected by means of a rod run through the hollow spindle. The one-piece body of the chuck is threaded and does not require the use of adapters to attach it to the spindle nose.

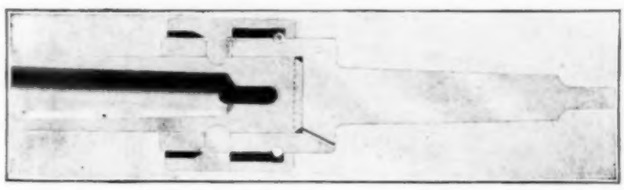
Superior Collet Chuck

The Superior Collet Chuck Co., Grand Rapids, Mich., has placed on the market the collet type chuck illustrated herewith.

The driving pins are pushed into driving position by the inclined interior wall of the collar. When the collar is raised so that the enlarged bore below the incline is opposite the driving pins they are free to move outward and away from engagement with the collet. In this position the weight of the collet will force the pins outward and the collet will then drop from the chuck. Raising the collar and allowing it to drop after the collet has been inserted will push the driving pins into engagement.

A stop ring on the chuck body limits the motion of the collar.

It is claimed that the drive is positive and that all collets having a concave driving surface can be used.



SUPERIOR COLLET CHUCK

Toledo Vertical Milling Machines

The machine here illustrated and described is an addition to the line of the Toledo Milling Machine Co., Toledo, Ohio.

In the design of this machine the unit method of construction has been carefully thought out. The table, saddle and knee are quickly removable and the feed-gear case with gears intact may be taken off by removing six screws. Similarly the speed gears and case may be removed.

The knee is held to the column by the usual dove-tailed slide and in addition is guided by a central taper gib.

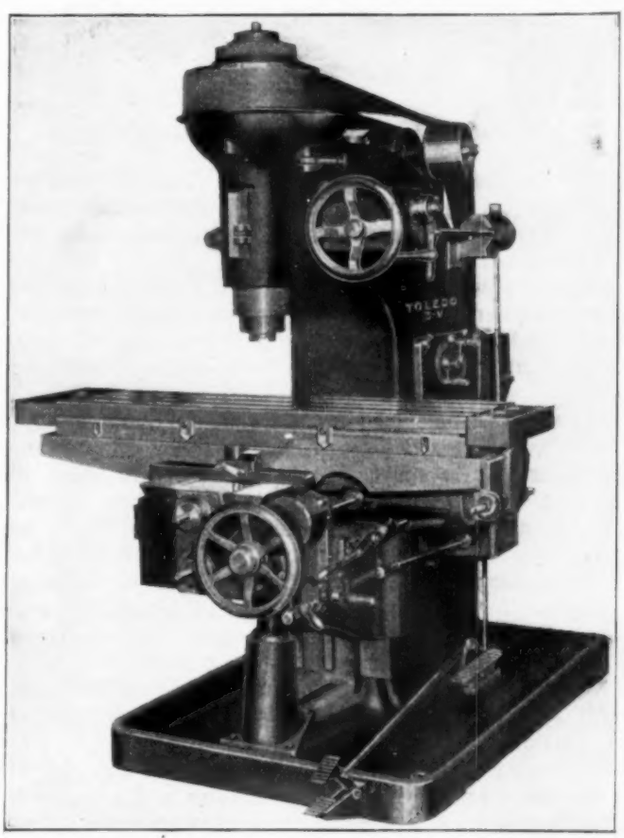


FIG. 1. TOLEDO VERTICAL MILLING MACHINE, FRONT

Specifications: Taper hole in spindle, No. 13 B. & S. Speeds: with open belt (8), from 97 to 411 r.p.m.; with back gears (8), from 18 to 76 r.p.m. Feeds: (16) from 0.004 to 0.710 per rev. of spindle. Table movement: longitudinal, 46 in.; traverse, 14 in. Vertical knee-movement, 14 in. Spindle movement, 6½ in. Table surface, 56 x 14 in. Weight, 7,000 lb.

The saddle is 4 in. longer than the table, thus providing more than ordinary support for the table at extreme ends of travel.

The movements of the knee, saddle and table are all controlled from one operating position and, by means of an engaging lever, the control of any of these move-

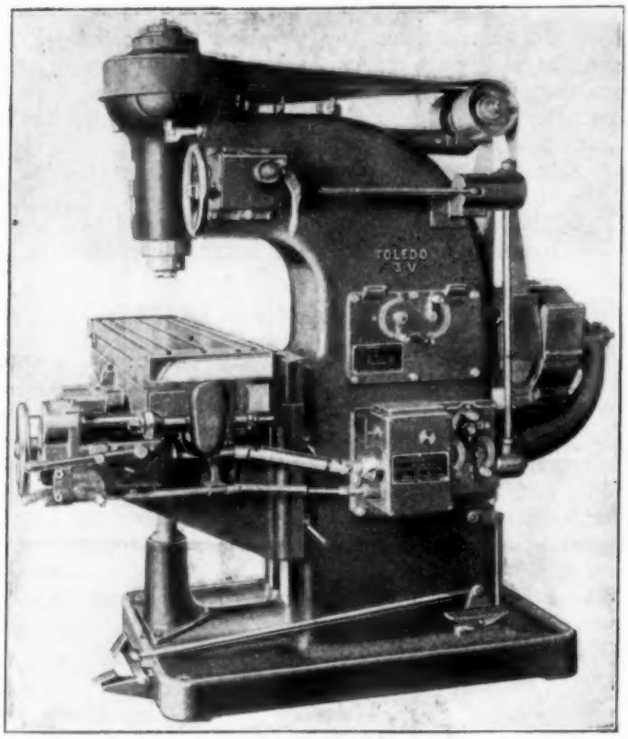


FIG. 2. TOLEDO VERTICAL MILLING MACHINE, SIDE

ments can be transferred to the centrally located handwheel on the knee. The feed mechanism is so designed that it is impossible to engage more than one feed at a time.

Rapid traverse is provided for the knee, saddle and table and when in use the regular feeds are disengaged automatically and vice versa.

Provision is also made for table control from the rear.

The main spindle bearing is 3½ in. in diameter and runs in two phosphor-bronze bushings each 4½ in. long and spaced 3 in. apart. An adjustment for wear is provided. End thrust of the spindle is taken by ball bearings at each end of the main bearing. The pull of the belt is taken by a large auxiliary bearing at the top of the machine so that the spindle is not affected in any way. This auxiliary bearing is adjustable and is provided with two specially designed ball bearings to take care of the belt pull.

Ample provision is made for lubricating all bearings.

All speeds and feeds are arranged in geometrical progression.

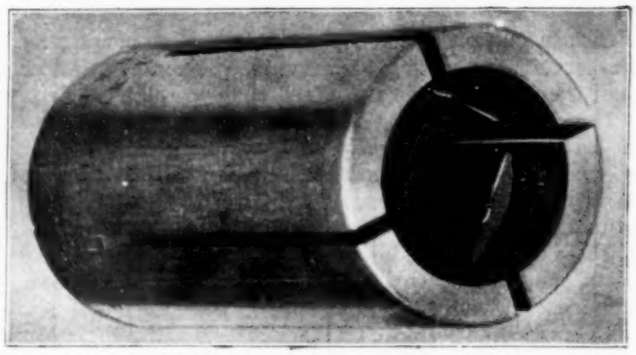
Cutters are attached to the spindle by a straight fit at the nose and are held in place by a draw-in-rod. Also there are two hardened-steel keys secured in two slots at the spindle nose. These keys engage similar slots in the cutter and furnish provision for driving.

All gears throughout the machine are of steel, heat-treated. The gears in the speed and feed cases run continuously in grease.

A rotary attachment having all regular and quick traverse feeds can be furnished.

Scully-Jones "Wear Ever" Turret Chuck

The Scully-Jones Co., Railway Exchange Bldg., Chicago, Ill., has added the "Wear Ever" turret chuck, shown in the illustration, to its line. This turret chuck



"WEAR EVER" TURRET CHUCK

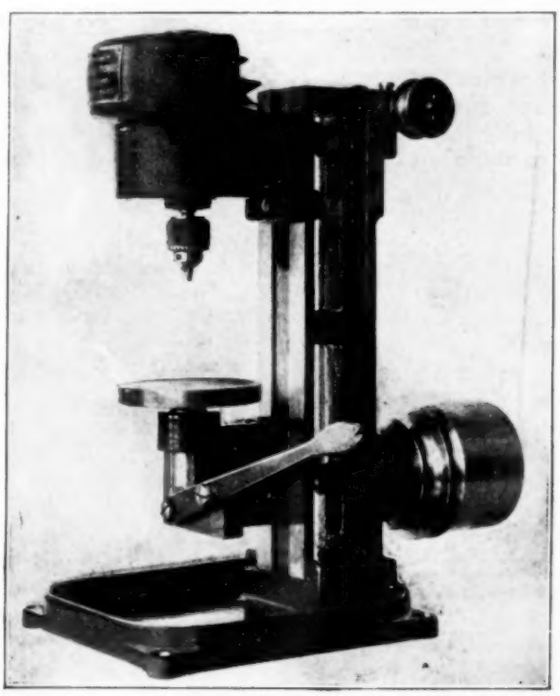
is similar in general construction to the other chucks of this line, but is designed to hold square-end tap shanks or other square-end shank tools in the tool holes of the turret. It is made in a variety of sizes to fit different diameters of tap shanks and can be fitted with standard bushings to fit larger turret holes.

Bicknell-Thomas Vertical Tapping Machine

The Bicknell-Thomas Co., Greenfield, Mass., has added to its line a vertical tapping machine for bench use having a capacity from 0 to ¼ in. taps.

This machine is made with an especially sensitive friction driving mechanism which, it is claimed, enables the operator to tap to the bottom of a hole without danger of breaking the tap. It is equipped with a two-step cone pulley for ¾-in. round belt, also tight and loose pulleys so that no countershaft is required.

The spindle has a reverse speed of twice the tapping speed, and the work table is easily operated by the lever shown. If desired, the work table can be removed and a special work-holding fixture used in its place. The machine stands 15 in. high and weighs 48 lb., complete.



BICKNELL-THOMAS VERTICAL TAPPING MACHINE

Business Conditions in England

BY OUR LONDON CORRESPONDENT

LONDON, March 2, 1920.

THE general conditions here are of the same order as reported heretofore. Prices of materials of nearly all kinds, manufactured or otherwise, are high, costs are increasing, wages are rising, and so, too, it may be added, are profits. Everybody seems dissatisfied, especially those who have acquired capital during the war and who are now seriously threatened with a levy, which, whatever the intention, can hardly be based entirely on war profits, as some, of course, have been spent. Demands for higher wages seem to be continuous. The Industrial Court heard a day or two ago in London a claim by the engineering and foundry workers for an increase of 15s. a week. A review of wages of this kind may be made every four months. Representatives of the workpeople required not only that wages shall be increased with increase in cost of living, but also that the standard shall be further raised. We may recall that in December last a rise of 5s. was granted, this in anticipation of increases in living costs which were expected to take place during the ensuing months. The award is expected daily. London engineering workmen are to press for a basic rate of 3s. an hour, and some urge "taking over and controlling the whole of the engineering industry by the operative engineers themselves."

FINANCIAL OUTLOOK

As to the other side of the table, it is no uncommon complaint that persons engaged in the conduct of engineering and industrial firms have lately been occupying themselves not so much with organization for output as with various favorable financial arrangements. Speculation has been so prevalent and excessive that pressure has been brought to bear, apparently with success, on the banks to prevent their help being given to anything but safe and legitimate enterprises. Capitalized on the basis of war profits, new public companies have been floated and placed on the money market at an astonishing rate. Reserves, too, have for a considerable time been steadily capitalized. In many of the new industrial companies the future has been burdened with cumulative preference shares at 7½, 8 and even 8½ per cent. It may be that the high rates at which the government has been appealing to the public for money are the reason. Certainly 5¾ per cent has been offered, although to the plain man it seemed to be quite definitely promised when the 5 per cent war loan was urged on the nation, that no government issue at a better rate would later be available. A recent marked fall in government securities has had as one explanation the suggestion that, in order to secure the immediate financial support not now being accorded by the banks, firms have been selling out.

THE METAL INDUSTRY

The metal market shows little in the way of decline, and almost the whole world has been inquiring of late for iron and steel, America, in particular, for sheets. In a large number of instances high prices are of no importance if delivery can be promised, but as regards the East in particular it has been said that the safeguards now placed in contracts on behalf of the seller are not without their effect in stopping orders. The truth is, however, that the home market could take almost the whole of the production of iron and steel, and also of coal. The shortage of coal in Great Britain for household purposes has lately become more marked, especially in some parts of London. In certain towns restrictions are imposed on the use of electricity for industrial purposes. At Hull, for example, a number of the engineering firms have been asked to reduce their load by 50 per cent, this being partly due to the lighting demand arising from dull weather and also to the poor quality of the fuel used for steam-raising purposes.

Aluminum manufacturers are in some instances endeavoring to meet the difficulties of the future by basing prices on those prevalent at the time of delivery. Of course this may mean a fall, though at present it looks very unlikely. But if it should mean a rise in price it is stipulated that this shall not exceed 10 per cent. An advantage that firms using aluminum as their raw material have over others is that they can immediately cover their requirements.

As to iron and steel, the Profiteering Department of the Board of Trade requested manufacturers to send in statements of costs, and this, according to report, included the pig-iron branches and several connected with finished steel and tin plate.

Much comment has been made on the finance of the cotton industry and warnings have been issued. Opening the newspaper at random one finds, for example, £32 offered for each £5 share (£2 10s. paid) in a Lancashire cotton mill, its latest dividend being at the rate of 240 per cent per annum. The fact is that new textile machinery cannot be had for periods that run literally into years, and this is particularly true of jute machinery. All textile fabrics are sold at increasing prices. In fact, distributors themselves have become alarmed at the profits being made, but there is scant sign of lowering of retail prices.

To judge by a reply given in the House of Commons recently, the total value of the works and plant, set up by firms engaged on munition production during the war and partly or completely paid for out of public funds, was about £85,000,000. Of this the government itself agreed to supply the sum of about £11,000,000 as a non-repayable contribution, the assets remaining with the contractors. Similarly the sum of £2,000,000 was expended as repayable contributions, while about £19,000,000 was spent by the government to meet the whole expenditure of the work, the assets remaining government property.

Summer time is to commence on March 28 and to end on Sept. 27 next. Despite rather feeble complaints from the farmers, and some reference to the ill effects on children who cannot be put to bed at the usual time, there is every probability that the change will be made from year to year; indeed an international basis is being proposed.

TO EDUCATE EX-SERVICE MEN

A national roll is to be issued, to contain the names of firms who undertake to employ disabled ex-sailors and soldiers on a definite percentage basis. The first issue, shortly to be made, shows up to the end of last year the names of about 9,500 firms, employing between them 1,482,130 workpeople, of whom 86,000 are disabled men. Apparently some 33,000 such men are still registered as unemployed, and a note of disappointment may be detected by some in the statement officially issued.

The Ministry of Labor expects through its training department to spend at least £22,000,000 during the next two or three years in the training of some 60,000 to 80,000 men. The schemes, both of bodies of employees and of employers, generally include a preliminary period of from six to eighteen months in a technical school or instructional factory, with a further period of eighteen months as a works improver, the man then becoming a member of an appropriate trade union. At least that was the suggestion of Mr. James Currie, head of the department, expressed in a paper he read recently before the Society of Arts. The men, discharged and disabled soldiers, are trained definitely for a trade, and an example is given of a man to be engaged subsequently as a turner on an ordinary engine lathe. Such a man, it is suggested, would be given preliminary lessons in measuring instruments, machine drawing and elementary mathematics. The man would be taught what the job is for and how to do it under the conditions of a modern factory. For men disabled by the war the scheme, it is suggested, will be in existence possibly till 1924. As in France, it may also be employed to train men, crippled as the result of accidents, in ordinary working, and there seems a pos-

sibility that it may later develop for general application to industry.

It has arisen out of the scheme inaugurated in 1915 by the Ministry of Munitions, and greatly extended in 1916, for producing single-operation workers for the intensive production of war material. Special recognition was given by Mr. Currie to the efforts of Sir Alfred Herbert and Mr. Oscar Harmer of the Coventry firm, Mr. Schofield of Loughborough Technical College, J. L. Hall, also of a well-known Coventry firm; Mr. Binns, a local official of the Amalgamated Society of Engineers, and H. Purdy and W. E. Buskard.

It is well known that in all probability a number of the leading engineering trade unions will amalgamate into one common union. Certain of the foundry unions are, however, definitely holding aloof for the purpose of forming their own amalgamation.

As applied to trade unions, an entirely new experiment is being made at the Birmingham University. Here systematic instruction in history, science, and government, together with a course of lectures on Shakespeare, will be provided for a number of men and women selected by the trade unions themselves, who will have to make arrangements regarding wages for the time thus occupied. The course is for two days a week. The men and women selected can be taken from the shops or may be officials of the trade unions, entirely at the discretion of the latter. The vice principal, Sir William Ashley, when making the announcement, requested publicity for the proposals which, he stated, had the support of labor leaders themselves.

Great Success of Industrial Fairs

Reference has been made in these columns to the British Industries Fairs organized by the Board of Trade and being held in London, Glasgow and Birmingham. The engineering and hardware exhibits are pretty well confined to the two latter cities. Very little of a novel nature has been exhibited, but, of course, this is not the purpose. Continental visitors, particularly from Scandinavia and from France, have been numerous, and merchants from Egypt, Nigeria, Japan, Brazil and the Argentine, as well as from Italy and Holland, have received especial mention. Admission to these fairs is by invitation, which is extended to business men only.

Official returns suggest that unemployment is diminishing more quickly for skilled workers than for unskilled. The demand for really skilled labor can hardly be satisfied while, on the other hand, unskilled or semi-skilled workmen have a much harder task to find employment. The resumption of work by the moulders naturally meant the almost immediate re-engagement of the skilled and other engineering workers who were put out of employment as a result of this very unwise strike.

High Cost of Petrol

Looming up as a handicap to motoring, whether for pleasure or profit, and therefore to the motor industry, is the rapidly rising price of petrol. At 9d. in 1896 and 1s. 4d. in 1906, the price in Great Britain is now 3s. 8½d. per gallon. The Automobile Association is promoting a petition to the head of the government, and states that "the exorbitant price exacted from the British public by the petrol interests is directly increasing your cost of living and bids fair to strangle road transportation and the motor industry." The action of combines is suggested, and it may be noted that benzol, the British competitor of petrol, though having certain advantages as to duties, is yet sold at the same price. The petitioners have, possibly not unexpectedly, received support in a report issued today by the Board of Trade, which appointed a subcommittee to investigate this subject. Figures are given and it is suggested that No. 1 petrol shall be sold at 2s. 10½d. and benzol at 2s. 8d. per gallon. Reference is made to the risk of a future famine and the danger arising from the fact that both supply source and machinery for transport and distribution "are mainly controlled by the same interests. The two main groups concerned are the Standard Oil Co. and the Royal Dutch Shell, whose great resources and wealth are indicated by the large number of companies they control." It is pointed out that "power alcohol is the only potentially unlimited source of supply."

London, March 12, 1920.

Two most important decisions bearing on the industrial future of Great Britain were made yesterday. On the one hand the special trade-union congress in London rejected direct action—that is, a general strike to force the nationalization of the mines on the government—declaring instead in favor of political action. Thus Great Britain, which since the armistice has lived from one strike or strike threat to another, escapes a general upheaval. The other decision is that of the Industrial Court considering claims for increases of wages in mechanical and other trades. It is now held to be necessary that the value of work done should govern the remuneration of workpeople, this value depending on the state of the market.

The Industrial Court, in fact, rejected a claim made on the ground of increased cost of living, but nevertheless awarded an advance on time rates and on piece rates. The engineering industry was reported as in an abnormal condition—owing to the great demand for engineering products in the devastated areas of Europe, and in the home and foreign markets generally, due to the necessary rehabilitation of the industrial world which has been deprived in a large measure of engineering products during the greater part of the war period. Reference was also made to the fact that, apart from advances to meet increased cost of living, wages in the engineering industry had remained unchanged for a number of years, and a comparison was made with wages of other industries and consideration given to the need for stabilizing the industry for a considerable period. On these grounds the advance was given.

The Shipbuilding Industry

The condition of the British shipbuilding industry may be gathered from the report published that Palmer's, of Jarrow and Hebburn, are in receipt of orders valued at between £15,000,000 and £20,000,000. The shipbuilding industries of the English northeast coast have work in hand for two or three years. The Clyde area is not behind and the Johnstone and other Scottish machine-tool firms that cater to them can be described as "full-up."

Inquiry at a well-known English ball-bearing works showed that at present the individual worker's output is at about two-thirds the pre-war rate.

The London market was somewhat astonished at the last meeting by the fact that quantities of steel amounting to several thousand tons have been bought by British firms from Germany at prices lower than those ruling in Great Britain. In fact it is said that further material is under offer at from £3 to £5 a ton below home prices. Sheffield, however, has refused to be perturbed, except perhaps on the ground that Germany could actually give delivery.

Reference was made recently in these columns to the census of production to be made in Great Britain in 1921. This is to deal only with essential trades. A complete census to cover all industries will probably be taken in 1922.

Welfare work was a pronounced feature of the war-time period, and much remains. An unusual extension has been announced in connection with a Rochdale firm. They have placed a firm of accountants at the disposal of workpeople, to give any information and advice on income-tax matters, the Rochdale firm being responsible for the expenses and supplying the necessary letters of introduction through their welfare department.

The Motor Boat, Marine and Stationary Engine Exhibition which opened today at Oylmpia, London, W., and which will remain open until March 20, contains about 150 exhibits, including one or two of machinery and small tools. Little of an outstanding character is shown. The Thorneycroft stand, however, showed the coastal motor boat No. 4 which ran the blockade in Petrograd Bay and destroyed a Russian cruiser. She is a skimmer with a single step and is 40 ft. on the water-line by 8 ft. 6 in. beam, the V-form 12-cylinder engines being of about 225 hp. With full load, 40 knots has been attained.

What Other Editors Think

The "Impossible" Has Happened

From *Railway Age*

IT IS AMUSING now to recall many things that were said about two years ago regarding the future of the railways. Director General McAdoo was engaged in trying to revolutionize not only the organizations, but also the operation and the physical properties of the railways, in the interest of unification. He seemed to be making such progress that it became a commonplace of conversation for people to predict that the railways would never be returned to private operation. Many of them based their prediction, not upon the ground that this would be undesirable, but that it would be "impossible." Everything would be so changed that the railroads not only would not, but could not, be returned. Nevertheless, they have been returned. . . . The transfer took place with so little trouble as to have a tendency to deepen the impression in the minds of many persons that the railroad problem has been solved and easily solved. *Unfortunately, that impression is erroneous. The passage of the new railroad legislation and the return of the railways to their owners is but a commencement of the solution of the problem. The railways are still just as short of facilities as they were when the Government turned them back, and it will take years of work and billions of new capital to make their facilities adequate. Former Director General Hines has stated that the properties have been returned to the companies in as good condition as they were received by the Government. This is certainly not correct as to passenger equipment, because the Government never, in more than two years of Government operation, bought a single passenger car. It can hardly be true as to locomotives and freight cars, because in two years of Government operation the Government bought only as many locomotives and freight cars as were required to replace the number ordinarily retired in one year. The equipment may be in as good condition in so far as repairs can make it so, as it was two years ago, but the amount of it is much more inadequate than it was then, and no repairs can make an old car as good as a new one. With regard to track, the Government has not laid anywhere near as many new rails and ties as the companies normally did under private operation.*

Government operation has caused numerous changes in the official personnel of the railways. It will be a long time before the roads will recover from the effects of the ruthless disruption of their official organizations which occurred under Government control. . . . Mr. Hines, in a recent statement, maintained that Government operation had been as economical as private management would have been. That is a matter of opinion. Under Government operation, railway expenses increased $1,600,000,000 a year. The *Railway Age* does not believe that an equal increase in expenses would have occurred under private operation. . . . At any rate, both Government operation and the new railroad legislation together will not solve the railroad problem. Under the new legislation the Interstate Commerce Commission and the railway managements may solve it, but they will not solve it unless there is the closest and most intelligent and friendly co-operation between the commission, the railroad managements, and the shipping and traveling public. Some people are disposed to say that the railroads have been returned, not to their owners, but to the Interstate Commerce Commission. We do not believe that is true in the sense in which it is meant. The commission has been given greatly increased power, but we believe that the future attitude of the commission, railway employees and the public toward the railways can be and will be determined chiefly by the railroad managements themselves. We believe that the railroad managements can cause private management to fail. We also believe that they can cause private management to succeed, and that by the exercise of diplomacy, public spirit and efficiency they will make it succeed.

Trading Conditions With Germany

From *Mechanical World, England*

THE ratification of the Peace Treaty has led the government to put into effect immediately the arrangements we have already outlined for dealing with enemy debts. All persons owing money to Germany or owed money from that quarter are therefore requested, if they have not already received a notification as a result of having registered themselves with the public trustee, to put themselves into communication with the comptroller of the clearing house, Cornwall House, Stamford Street, S.E. 1. In the case of other countries, debts will be collected directly between the concerned, but in the case of Germany collection of debts can only take place through the clearing houses which have been established in London and Berlin. Another and even more important announcement, which is the direct sequel of the ratification of the Peace Treaty, is the government giving notes as to the conditions under which trading may take place with Central Europe. Although the war with Germany is officially over, this by no means implies that there is an immediate return to pre-war conditions. Traders will find that there are still a few restrictions which must be complied with. . . . The position created by the judgment of Justice Sankey in regard to the right of the Government to prohibit importation under the customs consolidation act has left the position in such doubt that for the moment the goods dealt with in that way are presumably freed of restrictions, but steps will no doubt be taken to insure that the Government view shall be given effect through the medium of legislation. For this reason traders are warned that although they may make arrangements for imports during the interregnum, goods not actually delivered by the time new legislation is passed will not necessarily be admitted because they are ordered now. The necessities of the country will be the deciding factor.

SPARKS FROM THE WOR

Valentine Francis

British Trade-Mark Law Amended

A new trade-mark amendment act has just been put into effect in Great Britain. Under the provisions of this act, any trade mark which has been actually in use in trading operations for a period of two years can be registered by the user thereof.

In this way many marks which could not have been registered under the old law, such as geographical terms, surnames and descriptive words, may now be registered.

Many foreign countries require the filing of a certified copy of home registration as a prerequisite of registration in the foreign country. This regulation has prevented the owners of many valuable but unregistered trade marks from obtaining protection in foreign countries.

The National Foreign Trade Council points out that similar legislation is greatly needed in the United States. A large number of trade marks are used by American manufacturers which are incapable of registration under the provisions of the present trade-mark law; usually because they are either geographical, the mere name of a person or persons not used in a particular or distinctive manner, or words or devices which are descriptive of the goods or of the character or quality of such goods. Many of these marks have, through extensive use and advertising, become extremely valuable. Yet, because they cannot be registered in this country, their owners are not able to register them in countries which require the certified copy of the home registration and are, therefore, open to piratical attacks by dishonest foreign traders.

Recently an attempt was made in Portugal to steal over forty American automobile trade marks. Similar attempts are of frequent occurrence, and can be prevented only by a revision of the U. S. trade-mark statutes.

Summer Meeting of the S. A. E.

The usual summer meeting of the Society of Automotive Engineers will be held at the usual place—Ottawa Beach on the eastern shore of Lake Michigan. The meeting is set for June 21-25 inclusive.

The program for recreation and sport is one to look forward to, and over two hundred prizes will be awarded. Tennis, baseball, golf, trapshooting, races, water sports and special sports will be staged, with expert amateurs in charge. There will be dancing every evening (Monday excepted), and the ladies especially are promised an excellent time.

One professional session will be held each day. These will be as follows: Monday, June 21, Standards and Business Sessions; Tuesday, Fuel Session; Wednesday, Transportation Session; Thursday, Farm Power Session; Friday, June 25, Production Session.

The meeting committee has arranged for excellent hotel accommodations.

Chicago Pneumatic General Offices Removed from Chicago to New York

The general offices of the Chicago Pneumatic Tool Co. were transferred to the Chicago Pneumatic Building, a new ten-story structure erected for the exclusive use of the company at 6 East 44th St., New York.

The move was accomplished without appreciable interruption to business over the week end. Arrangements, carefully made in advance, made possible the jump of this large organization across half of the continent without interference to the normal routine of business except for a brief period.

The Chicago district sales branch, previously in the Fisher Building, was moved at the same time to new quarters in Chicago, at 300 North Michigan Boulevard. The Chicago service branch, formerly at 521 South Dearborn St., has been consolidated with the sales branch at the new address. J. L. Canby, district manager, will continue to serve the company's customers in the Chicago and Milwaukee territories.

Production of Trahern Pumps Increased

The George D. Roper Corporation, Rockford, Ill., manufacturer of the Trahern pump, announces that its recent amalgamation will enable it to increase production of its pumps more than 50 per cent. This amalgamation was formed by the merging of the Trahern Pump Co., Eclipse Gas Stove Co., American Foundry Co. and the Rockford Vitreous Enamel Manufacturing Co. into the George D. Roper Corporation. The new firm will soon be housed in a new model plant, costing $1,500,000.

The "Trahern" pump will still retain its trade mark. The type of Trahern pump best known to the machinery trade is the rotary geared circulating pump, suitable for use on metal working machines for delivering coolant to the cutting tools.

Bartlett-Hayward Plant Offered For Sale

The War Department authorizes publication of the following statement from the office of the Director of Sales:

The Director of Sales announces that the Ordnance Salvage Board, War Department, is offering for sale by informal bids, the site, buildings and plant equipment of the Park Plant of the Bartlett-Hayward Co., situated at the corner of Columbia Ave. and Putnam St., Baltimore, Md., bids for which will be received until 12 o'clock, noon, April 15, 1920, by the Ordnance Salvage Board, Munitions Building, Washington, D. C.

This plant was erected and designed for the manufacture and assembling of 155-mm. shrapnel projectiles and is particularly adapted for the manufacture or assembling of automobiles or motor trucks. It is located on the Baltimore & Ohio Railroad which has two spur tracks entering the property, is near the heart of the manufacturing district of Baltimore, and is in proximity to that city's docks and wharves. The buildings are of substantial construction, and provide an aggregate floor space of approximately 450,000 sq.ft.

Included in the structures are five machine shops, tool shops, office buildings, assembling building, lunchrooms, a storage building, hospital, oil house and smaller buildings, all of which are of mill construction. The machine shops are sided with steel sash. The boiler house and addition, two heat-treating buildings and three transformer houses are built of brick. The forge shop, pump house and four cooling sheds are steel frame, brick and galvanized-iron structures with steel louvre sash.

The equipment includes a 500,000-gal. and a 60,000-gal. steel oil tank, two pressure oil tanks, one cooling tower, one 50,000-gal. water tank and such plant facilities as concrete roads and walks, railway trackage, coal trestle, truck scales, wood and wire fencing, electric light poles and feeders, four electric cranes, one motor generator set, heating, plumbing and lighting fixtures, gas, sewer, water and oil piping, transformers, fire plugs, etc.

No bid forms are necessary in submitting offers for this property and any offer in writing will be considered. The plant is in shape for the immediate resumption of activities and may be inspected by applying to the chairman, Baltimore District Ordnance Salvage Board, Columbia Ave. and Baltimore & Ohio Railroad, Baltimore, Md.

LD'S INDUSTRIAL FORGE

News Editor

War Department Offers Surplus Stocks to Tornado-Swept Areas

The War Department authorizes publication of the following from the Office of the Director of Sales:

Following is a copy of a telegram sent out recently by the Director of Sales, War Department, to the mayors, postmasters, and similar officials in those areas which were swept by tornadoes, calling to their attention the fact that the War Department is ready to place at their disposal large quantities of equipment and materials adaptable in the rehabilitation of industrial institutions and agricultural communities:

It is with deep regret that I have read of the calamity suffered by your community. The War Department has large surplus stocks of plant equipment, contractors' equipment, building supplies, other than nails, other equipment and materials adaptable in the rehabilitation of industrial institutions, and a limited quantity of telephone wire and cable. Deliveries of this equipment can be effected promptly; prices are reasonable.

It may be to the mutual advantage of the Government and your stricken industries to get into direct communication. We will give inquiries and orders from your community emergency consideration. Please bring this suggestion personally to the attention of those industries in your community which may be in the market for surplus stocks held by the War Department, and give it as wide publicity as possible through the newspapers of your city and section. Inquiries by telegram or letter, outlining the character of the equipment or supplies desired, should be directed to Director of Sales, Munitions Building, Washington, D. C. We will have a representative of the War Department ascertain the actual needs of all prospective purchasers and advise each promptly of what part of his needs the War Department can supply.

The War Department has expedited the rehabilitation of several large industrial plants destroyed by fire by supplying promptly machinery and other plant facilities needed.

E. C. MORSE,
Director of Sales, War Department.

Twist Drill and Drop Forge Concerns to Vote on Merger

Special meetings of the stockholders of J. H. Williams & Co., at Brooklyn, N. Y., and of the Whitman & Barnes Manufacturing Co., at Akron, Ohio, have been called for April 2, for the purpose of ratifying an agreement entered into by their respective presidents, for the merging of the Chicago, Ill., and St. Catherines, Ont., plants of the Whitman & Barnes Manufacturing Co. with J. H. Williams & Co.

When ratified, this plan will contemplate the operation by J. H. Williams & Co. of drop forging and drop-forged tool plants at Brooklyn, N. Y.; Buffalo, N. Y., and West Pullman, Chicago, Ill., and at St. Catherines, Ont., Canada.

The plans of J. H. Williams & Co., under this arrangement, call for a considerably extended business and for service to its customers in the location most convenient for them. The Whitman & Barnes Manufacturing Co. will continue its business of making twist drills, reamers, etc.

Baker R. & L. Co. Changes Business

The Baker R. & L. Co., Cleveland, Ohio, announces an expansion of its business which will allow for greater production of Baker industrial trucks and Raulang bodies. The change includes the sale of the electric passenger-car business to Rauch & Lang, Inc., Chicopee Falls, Mass.

The manufacturing space made available will result this year in tripling the industrial truck output and doubling the body production. E. J. Bartlett is general manager.

The Baker R. & L. Co. started business over sixty years ago building coaches and later has been prominently identified with the electric vehicle industry.

The first electric road vehicles offered for sale on the American market were built by this company and fifteen years ago attracted much attention with the Baker Torpedo Kid, an electric racing car that established the world's kilometer record and attained a speed of 128 miles per hour at Ormond Beach, Fla.

All Express Charges to Canada Must Be Prepaid

Announcement has been made that on and after April 15, the American Railway Express Co. will require prepayment of express charges on all shipments which are destined to points in Canada.

This action, which is in line with that taken by the railroads some time ago, has been made necessary because of the heavy rates of exchange, which make the Canadian dollar worth only eighty-six cents in United States money.

The tariff rates from express offices in the United States to those in Canada have always been calculated in the currency of this country. The express company has found that it thus loses fourteen cents on every dollar of express charges when collection is made in Canadian funds.

The date of the enforcement of this new rule, according to express officials has been placed in advance so as to give shippers in the 'States an opportunity to make necessary arrangements with customers in Canada.

Trade Currents from New York and Chicago

NEW YORK LETTER

Little change has been apparent in the local machine-tool situation during the past week. Sales have decreased slightly, but dealers report business in general to be satisfactory.

The General Electric Co. supplemented its Bridgeport list of the week previous with inquiries for new equipment for its Pittsfield, Mass., and Schenectady, N. Y., factories.

The Spalding Chain Corporation, of Bloomfield, N. J., has inquiries out for a substantial list, and it is reported that the Submarine Boat Corporation will shortly enter the market for plate-making and pneumatic equipment.

The Fairbanks Co., through E. R. Seiter, sold a 14-ft. boring mill weighing 50 tons to Theo. A. Crane & Co., of Brooklyn. This is said to be the largest mill in this section.

The New York representatives of several Cincinnati machine-tool factories report that deliveries by their firms will be uncertain due to a foundry fire in which large numbers of patterns were destroyed. In the pattern room at the time were patterns belonging to a number of different machine-tool makers who depended on the foundry destroyed for their castings.

The Lehigh Valley has completed its recent list, and is said to be temporarily out of the market.

The American Manufacturers' Export Association reports a constantly increasing demand for machine tools for export to countries where the exchange rate is favorable. The Belgian Commission was a recent inquirer through this organization.

The used-tool market is steady with all lines active. Floor stocks are more complete at this writing than has been the case for some time, and a greater variety of tools is noticeable.

CHICAGO LETTER

For the first time since just a year ago, shipments of goods on order this month by machine-tool dealers equal or exceed the amount of new business. However, the swollen pile of back orders has been but slightly reduced. For twelve long months nearly every dealer received from 50 to 100 per cent more orders than he made shipments, but for March the average report is that orders are 70 per cent of shipments.

Delivery dates on new business are no better than in the past, for it will take several months of steady production to bring things back to a reason-

able basis. February, on account of transportation difficulties, was about the worst month for deliveries in a year, but March has made up for it, and the change is welcome.

Trade conditions show no material change since last week's report. Business continues good and regular, but on a scale materially reduced from the abnormal standard set in the past several months. The reduction is attributed to various causes by different dealers and manufacturers. Some think that slow deliveries are the cause, there being no reason for ordering machines that will not be delivered for six or nine months.

The railroads remain largely an unknown quantity. The Great Northern is out with an inquiry for a comparatively small line, and it is understood that appropriations for machine replacements have been approved by the governing bodies of many roads. Among those mentioned in this class are the Rock Island, Northwestern and St. Paul. The volume of these authorizations remains problematical, and will be so until requests for bids are made.

In connection with the fall-off in new business, some speculation is being indulged in as to the amount of possible cancellations which may be laying dormant in the back-order files. Many cancellations are claimed to be the result of a user ordering the same article from more than one source, and then, upon receipt of shipment from the concern first producing the goods, cancelling the order on the other dealer. Now that a breathing spell is being granted, a check-up process is starting with a view to eliminating this class of fictitious ordering as much as possible. It is not felt that any appreciable amount of this duplication will be found, as the total number of cancellations received during the past twelve months runs lower than 1 per cent.

Little Things

He rang in a little sooner
  Than the fellows in his shop;
And he stayed a little longer
  When the whistle ordered "Stop".
He worked a little harder
  And he talked a little less;
He seemed but little hurried
  And he showed but little stress,
For every little movement
  His efficiency expressed.
Thus his envelope grew just
  A little thicker than the rest.
He saved a little money
  In a hundred little ways;
He banked a little extra
  When he got a little raise.
A little "working model"
  Took his little "leisure" time;
He wrought each little part of it
  With patience most sublime.
Now it's a very little wonder
  That he murmurs with a smile,
As he clips his little coupons:
  "Are the little things worth while?"

Arthur L. Ormay

ARTHUR L. ORMAY, illustrator-in-chief of the McGraw-Hill Co., died at his home in Brooklyn, March 23.

Mr. Ormay was born in Kassa, Hungary, May 25, 1881. After the usual preliminary education he entered the Polytechnic of Budapest, from which he graduated in June, 1905, with the degree of M. E. He came to the United States the following year and shortly afterward joined the staff of the *Engineering News* as draftsman and letterer. He stayed with this paper for about three years. He then went to John Hill with a proposal to establish a drafting department to do

ARTHUR L. ORMAY

the work of the papers of the Hill group, which at that time consisted of the *American Machinist*, *Power*, and *Engineering and Mining Journal*. Mr. Hill considered the proposition favorably and one of Mr. Ormay's first jobs was the making of a difficult boiler chart for *Power*. This piece of work at once stamped him as just the man for technical work. In the establishment of a separate illustrating department he had not only charge of the drafting, but of layout and retouching work.

Mr. Hill started *Coal Age* in October, 1911, and in December of the same year bought the *Engineering News*. The work for the two additional papers was also successfully handled under Mr. Ormay's supervision. It was during this period that he developed what is known as the Ormay Process of Illustration, patented in 1915.

The consolidation of the McGraw and the Hill companies in 1917 after Mr. Hill's death broadened Mr. Ormay's duties and responsibilities, as he then had ten technical papers to serve. He was given the title of Illustrator-in-Chief, which he held at the time of his death.

In addition to his other talents, Mr. Ormay was noted for his pen-and-ink sketches of people. One of his best was a large likeness of Mr. Hill, which was finished shortly before Mr. Hill's death. This portrait displays an execution and artistic talent of a very unusual quality.

Stanley Rule and Level Co. Votes To Sell Out

At a meeting of the stockholders of the Stanley Rule and Level Co., New Britain, Conn., held at the offices of the corporation recently it was voted to accept the previous recommendation of the directors in advising selling the effects of the concern to the Stanley Works. The price paid will be $6,000,000 as suggested and the Stanley Rule and Level Co. will protect the minority stockholders on its holdings to the extent of guaranteeing par on the preferred issue, as suggested by the Stanley Works, until June 1, 1920.

Detroit Gear and Machine Co. Is Building a New Plant

The Detroit Gear and Machine Co., Detroit, Mich., is constructing an entirely new fireproof building which will be ready for occupancy in about six weeks.

When the building is completed the firm will consolidate its three separate plants which it now operates. It is buying new machinery for equipping this plant and is still in the market for more. It is producing gears and complete transmissions for automobiles, and machines along this line will interest them.

Cornell's Engineering Graduates Meet to Form Society

A meeting of graduates in engineering at Cornell University will be held on the evening of April 9, in the Engineering Societies Building, New York. The meeting is called by the Cornell Society of Civil Engineers, partly with the idea of forming a general Cornell engineering society, now that the different engineering schools at Cornell are to be combined into one general engineering college. The new dean of the combined college, Prof. Dexter S. Kimball, will be one of the speakers.

Drake Lock-Nut Co. Has Foreign-Trade Improvement

An idea conceived by George F. Drake, vice president of the Drake Lock-Nut Co., of San Francisco, Cal., has been a big factor in smoothing out foreign-trade relations, and a great help to foreign buyers.

This plan enables the company to quote C.I.F. to any usual seaport in the world. A buyer in Johannesburg, Buenos Aires or Singapore, seeking an American product which is advertised and which he may want to try, has first-hand information as to the cost of the merchandise landed at his sea port.

New Radio Trucks Will Soon Be Given Trials

The Radio operating truck, mounted upon a White chassis and being manufactured by the Mulholland Co., of Dunkirk, N. Y., is well on toward completion. The body is totally inclosed and is 120 in. long, 64 in. wide and 64 in. high with a door on the right-hand side and two glass windows provided with canvas flaps. Room is provided for three operators and one squadron radio officer. One bench supports a ground radio telephone set, one crystal detector receiving set and one low frequency amplifier. Storage batteries are held in clamps underneath the bench. A continuous-wave radio telegraph transmitting and receiving set is installed on another bench. A 6-volt circuit, comprising two lamps, is connected to storage batteries while a 110-volt 2-lamp circuit may be used when a suitable external supply is available.

External brackets are provided for carrying antenna masts. Each set is provided with its own antenna.

The ground radio telephone set will in the future be replaced with a higher-powered telephone set which will increase two-way telephone communication to a distance of approximately fifty miles. These higher powered sets are not available at the present time.

The radio telephone set will have a transmitting range of approximately fifteen miles under ordinary conditions for work from ground to plane and vice versa. The transmitting range of the continuous wave set is in the neighborhood of fifty miles. The receiving ranges of these sets will depend upon the local conditions and mainly upon the power of the transmitting set whose signals are being received.

Engineering Advertisers' Association Elects Officers

The first milestone of the Engineering Advertisers' Association of Chicago was passed on March 9 at the Auditorium Hotel, at which time the following officers were elected for the ensuing year: President, A. H. Hopkins, advertising manager, C. F. Pease Co.; vice president, J. J. Arnsfield, advertising manager, Fairbanks-Morse Co.; secretary, G. S. Hamilton, advertising manager, American Steam Conveyor Corporation; treasurer, E. I. Pratt, advertising manager, Kellogg Switchboard and Supply Co.

According to a clipping from the Sheffield (England) *Telegraph*, transmitted by Consul William J. Grace, so many second-hand lathes have been thrown on the British market recently, through the dismantling of munition plants and other war activities, that there is now no call for them. Purchasers have found difficulty, the clipping states, in converting the lathes from the special purpose for which they had been used, to general utility machines.

Obituary

JOHN CLINTON SCOTT, 70 years old and for nearly 35 years head of the tool-steel department of the Bourne-Fuller Co., Cleveland, Ohio, died on March 21. The news of his death came as a shock and surprise to his host of friends in the steel, machinery and manufacturing trades. Mr. Scott originated many of the tool-steel analyses used today and was the author of a book, "Tool Steel and Its Uses." He was looked upon as a national authority on all phases of tool steel and Scott's tool steel was named for him.

J. N. DERBY, vice president of Manning, Maxwell & Moore, Inc., New York, died at his Greenwood, Conn., home on March 28 from heart disease.

GEORGE H. WEBB, treasurer and general manager of the Pawtucket Manufacturing Co., Pawtucket, R. I., died on March 6.

N. HOWARD EASTON, president of the Pawtucket Manufacturing Co., Pawtucket, R. I., died on March 14.

Business Items

The Cincinnati Shaper Co., Cincinnati, Ohio, has just completed its new addition which, it is expected, will double its production.

The export department of the Canton Foundry and Machine Co., Canton, Ohio, is now at the International Machinery Exposition, Grand Central Palace, New York City.

Domestic Exports of Metal-Working Machinery from the United States by Countries During January, 1920

Countries	491 Lathes	492 Other Machine Tools	493 Sharpening and Grinding	495 All Other
Austria	$4,875	.....	.....	.....
Belgium	34,275	$20,299	$29,081	$66,258
Denmark	4,098	4,570	2,250	4,733
Finland	.....	2,563	.....	.....
France	101,691	151,456	79,809	385,171
Germany	.....	.....	.....	60,100
Greece	.....	1,103	.....	.....
Italy	9,637	16,605	.....	36,641
Malta, Gozo and Cyprus Is.	.....	.....	125	.....
Netherlands	17	1,459	1,223	8,013
Norway	3,524	7,337	6,209	16,937
Poland and Danzig	5,519	1,307	154	5,700
Portugal	2,559	136	832	1,821
Roumania	.....	.....	.....	1,155
Russia in Europe	.....	.....	.....	85,642
Spain	22,104	10,319	5,158	25,857
Sweden	18,551	17,343	9,422	51,313
Switzerland	112	2,831	1,405	7,006
Turkey in Europe	.....	.....	210	.....
England	137,507	174,093	124,291	306,417
Scotland	.....	.....	1,315	5,620
Bermuda	.....	45	.....	.....
Canada	126,202	220,564	66,693	198,979
Costa Rica	.....	342	.....	245
Guatemala	.....	52	.....	.....
Honduras	1,433	509	.....	2,771
Nicaragua	.....	102	.....	.....
Panama	.....	536	.....	489
Salvador	.....	89	27	.....
Mexico	2,241	3,464	2,479	4,617
Newfoundland and Labrador	.....	60	1,060	.....
Jamaica	.....	126	.....	350
Trinidad and Tobago	145	203	5	.....
Cuba	9,250	54,431	7,709	29,805
Danish West Indies	.....	51	.....	.....
French West Indies	.....	14	.....	875
Haiti	.....	113	.....	.....
Dominican Republic	1,250	913	.....	1,291
Argentina	3,638	11,909	887	5,321
Brazil	14,328	6,196	348	2,867
Chile	7,581	3,537	215	863
Colombia	.....	596	137	866
Ecuador	.....	199	.....	189
Peru	4,777	9,109	876	1,893
Uruguay	3,103	403	88	133
Venezuela	106	116	65	95
China	11,993	26,193	1,764	18,795
Kwantung	42	.....	.....	.....
Chosen	530	.....	.....	34
British India	21,697	133	254	7,086
Straits Settlements	1,039	322	.....	.....
Other British East Indies	.....	221	.....	.....
Dutch East Indies	8,415	3,360	9,269	2,741
Hongkong	362	234	.....	35
Japan	45,461	41,646	31,787	225,852
Siam	.....	292	.....	250
Australia	4,759	9,959	6,283	20,188
New Zealand	1,192	2,238	358	1,769
French Oceania	.....	.....	15	.....
Philippine Islands	4,904	5,795	358	11,571
British South Africa	12,354	664	524	2,132
French Africa	.....	235	.....	.....
Madagascar	.....	.....	.....	150
Morocco	.....	381	.....	892
Egypt	.....	.....	1,689	.....
Total	$631,271	$816,773	$394,374	$1,611,528

J. C. Dillenbeck and George L. Bassler have formed the D & B Sales Co., with Chicago office at 549 Washington Boulevard. This company will specialize in the sale of abrasive grinding wheels, etc. They are manufacturers' agents for the American Emery Wheel Works of Providence, R. I. Both members of this company were formerly with the Abrasive Co., of Chicago, Ill.

The Philadelphia Textile Machinery Co., Philadelphia, Pa., has started the erection of an addition to its plant at Sixth St. and Tabor Rd. The new building will be four-story, reinforced concrete, 146 x 77 ft.

Carl F. Gerlinger, W. G. Vassall and R. L. Chapman of Dallas, Ore., have incorporated the Dallas Machine and Locomotive Works and plan to engage in construction, erection and repair of motors, locomotives, machinery, engines and foundry products.

The Progressive Die and Tool Co., Columbus, Ohio, has been incorporated by H. F. Gray, M. Voltz, G. Snashall, H. E. Brennan and J. P. Michael. The company is a reorganization of an individual concern which has been in operation for about five years. H. F. Gray is head of this company.

Manning, Maxwell and Moore, Inc., New York City, has announced that its branch office in San Francisco has moved to 40-42 Fremont St.

The Hooven Radiator Co., has moved into its new factory and office at 410-420 North Western Ave., Chicago.

The Cleveland office of the Chase Metal Works and Chase Rolling Mill Co., Waterbury, Conn., is now located at 310 Engineers Building, and is conducted by W. B. Fairfield and C. K. Lenz.

The Lafayette Tool and Equipment Co., Lafayette, Ind., has appointed Societe Anonima Italiana Alfred Herbert, 42 Via Cajazzo, Milan, Italy, as its sole agent for the sale of the Lafayette universal grinding machine.

Prominent business men of Lynch and Harlan, Tenn., have organized the Harlan Electric and Machine Works, and announcement has been made that a $75,000 machine shop will be immediately established at Harlan. W. H. Rogers heads the new company. The size of the building to be constructed will be 80 x 100 ft.

The Plant Engineering and Equipment Co., Inc., of New York City, manufacturer of Corliss valve steam traps, Mason condensation meters and other power and heating specialties, announces the opening of an office in Newark, N. J. M. Wm. Ehrlich will be the New Jersey manager in charge with headquarters at Newark, N. J., and a sub-office at Lyndhurst, N. J.

The Hyatt Roller Bearing Co. has moved its New York office to 6th Ave. at 41st St. and invites its friends to drop in whenever they are in New York.

Personals

PROF. ARTHUR D. BUTTERFIELD has been appointed educational director of the entire plant of the Norton Co., of Worcester, Mass. Professor Butterfield was formerly in the mathematics department at the Worcester Polytechnic Institute and is also secretary of the Technical Alumni Association.

R. G. PROUTY, formerly with the American Saw and Manufacturing Co., has resigned to take charge of the sales of the Moore-Stillson wrenches for the Moore Drop Forging Co., Springfield, Mass.

D. J. FLYNN, openhearth superintendent of the Tacony Steel Co., Philadelphia, Pa., has been transferred to the New Castle plant of the Penn Seaboard Steel Corporation, with which the Tacony Steel Co. recently merged.

EDWARD F. BUIE has been appointed by the Victor Saw Works, Inc., Springfield, Mass., as its Pacific Coast representative, to succeed Victor Pezzini, who has resigned from its employ. Mr. Buie was formerly connected with the Union Hardware and Metal Co., Los Angeles, Cal.

E. E. YAKE has resigned his position as engineer in charge of the inspection and maintenance department of Gilbert and Barker Manufacturing Co., Springfield, Mass. Mr. Yake is going with the Walworth Manufacturing Co. to do similar work.

H. C. FOSBERG, head of the experimental division in the engineering department of the Art Metal Construction Co., Jamestown, N. Y., has resigned his position and will be succeeded by J. R. Turner, acting head of the department.

RAY T. MIDDLETON has resigned as general sales manager of the Standard Steel Castings Co., Cleveland, Ohio, to become vice president and director of sales and advertising for the Kelly Metals Co., of Chicago, Detroit and Los Angeles. Mr. Middleton will have his headquarters in Chicago.

R. R. KNAPP, formerly connected with the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has become sales manager of the Reliance Spring and Manufacturing Co., Brooklyn, N. Y.

H. DEVERELL, sales engineer, has severed his connections with the Deverell, Spencer & Co., Baltimore, Md., and has opened an office at 1401 Lexington Building, Baltimore, Md. Mr. Deverell will be engaged in the elevating, conveying and transmission machinery business.

WILLIAM E. STEVENS, head of the New England sales force of the Stanley Works, has been employed by the company for fifty years. Mr. Stevens entered the factory at nineteen and held various positions up to his present one.

P. J. F. BATENBURG, for ten years identified with the automotive engineering field, has been appointed chief engineer of the Mitchell Motors Co., Racine, Wis. At one time he was chief engineer of the Four Wheel Drive Auto Co., Clintonville, Wis.

WILLIAM TAYLOR has been appointed chief engineer of the Scripps Motor Co., Detroit, Mich. Formerly, he was motor engineer of the Liberty Motor Car Co. He also designed the Militor motorcycle engine.

CHARLES S. AMADON has resigned his position as general manager of the J. N. Lapointe Co., New London, Conn., to become president of the Euclid Broach and Machine Co., Cleveland Ohio.

LOUIS E. PECK has resigned his position with the J. N. Lapointe Co., New London, Conn., to become treasurer of the Euclid Broach and Machine Co., Cleveland, Ohio.

C. L. GOODRICH, assistant superintendent of equipment, Pratt & Whitney Co., Hartford, Conn., has returned to this country after a several months' business trip in Chile.

Forthcoming Meetings

The Electric Hoist Manufacturers' Association will hold a meeting at 9 East 40th St., New York, on April 15.

The National Metal Trades Association will hold a convention at the Hotel Astor, New York City, on April 19 to 22, 1920. H. D. Sayre is the secretary.

The American Welding Society will hold its annual meeting at the Engineering Societies Building, 33 West 39th St., New York City, on Apr. 22, 1920, at 10:30 a.m. Howard C. Forbes is the secretary.

The National Chamber of Commerce will meet in Atlantic City, N. J., on April 26, 27 and 28.

The American Gear Manufacturers' Association wil hold a meeting at the Hotel Statler, Detroit, Mich., on April 29, 30 and May 1.

The American Supply and Machinery Manufacturers' Association, the Southern Supply and Machinery Dealers' Association and the National Supply and Machinery Dealers' Association will meet jointly on May 17, 18 and 19 at Atlantic City, N. J., at the Hotel Marlborough-Blenheim. F. D Mitchell is the secretary and treasurer of the American Supply and Machinery Manufacturers' Association, with an office at 4106 Woolworth Building, New York City.

The National Machine Tool Builders' Association will hold its spring meeting on May 20 and 21 at the Hotel Traymore, Atlantic City, N. J.

The American Society of Mechanical Engineers will hold its spring meeting at St. Louis, Mo., May 24, 25, 26, 27, 1920, and will have its headquarters at the Hotel Statler.

The American Iron and Steel Institute will hold its spring meeting at the Hotel Commodore, New York City, May 28.

The American Drop Forge Association will hold a meeting at the Hotel Marlboro-Blenheim, Atlantic City, N. J., on June 17, 18 and 19. E. J. Frost, of the Frost Gear and Forge Co., Jackson, Mich., is president.

The American Society for Testing Materials will hold its next annual meeting during the week of June 21, 1920, at the New Monterey Hotel, Asbury Park, N. J. This society has its headquarters in the Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa. C. L. Warwick is the secretary and treasurer.

Condensed-Clipping Index of Equipment

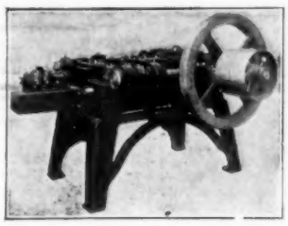
Patented Aug. 20, 1918

Wire Nail Machines

Jos. T. Ryerson & Son, Chicago, Ill.

"American Machinist," March 18, 1920

These are built in six sizes, and range from the No. 00 to the No. 4 size. The production capacities of the six sizes range from 500 nails per minute for the No. 00 to 175 nails for the No. 4. Specifications: Six sizes, from No. 00 to No. 4; capacities, No. 20 gage to 60d.; number of nails per minute, 500 to 175; horsepower required, ¾ to 7½; net weights, 900 to 7,600 lb.



Blowpipe, Brazing

Eclat Mfg. Co., Golton St., Smethwick, England.

"American Machinist" (Eng. edition), Feb. 28, 1920

A lever-type blowpipe, without springs or diaphragm. It is claimed as original in design, gas-way leading direct into the body containing a rubber-seated valve. A sleeve of rubber tubing round the spindle, operated and controlled by lever, keeps valve in position and acts as preventative against gas escape. By-pass is provided to avoid constant lighting. When lever valve is opened a clear gas passage is given, permitting an adequate supply of gas either with high or low pressure. A fixed flame can be obtained by regulating the nut screwed on valve spindle. Blowpipe can be supplied with or without valve or without valve and separate air control; all sizes from ⅜ to 1½ in. are being made.

Press, Deep Gap, Double Crank, Power

Toledo Machine & Tool Co., Toledo, Ohio.

"American Machinist," March 25, 1920

No. 210-A is particularly adapted for large blanking of the heaviest of stampings used in automobile and other work. Power is supplied by a 30-hp. motor at a speed of 1,200 r.p.m. allowing press to make twelve strokes per minute. Large gears are each 86 in. in diameter with a 9-in. face and are steel castings. Distance from bottom of frame to top of arch, 223 in.; floor space over all, 150 x 159 in.; distance between uprights, 60 in.; distance center of slide to housings, 20 in.; area of slide, 40 x 60 in.; area of bed, 56 x 85 in.; opening in bed, 24 x 56 in. Weight, 175,000 lb.

Attachment, Prestometer

Coats Machine Tool Co., Inc., 110 West 40th St., New York, N. Y.

"American Machinist," March 25, 1920

Used for gaging a 4½-in. diameter piston. Gaging point and instrument contact-point connected by a two-to-one lever, each ⅛ in. on scale represents 0.001 in. in the work. The anvil indicated by pencil is a ⅜-in. ball supported by a setscrew and a cup from above, can be set to project beyond surface of base. In gaging, piston should be located with pin holes horizontal and piston should be pushed longitudinally between gaging contact and the anvil. Special scale will show correctness or variation from standard. All parts of piston, as indicated on scale, can be gaged in one-quarter of a minute.

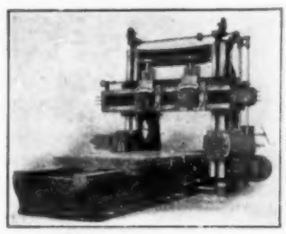
Planing Machine, Hiloplane

John Stirk & Sons, Ltd., Halifax, England.

Represented by Alfred Herbert, Ltd., 54 Dey St., New York.

"American Machinist," March 18, 1920

Stroke control entirely does away with table dogs and enables operator to set both ends of travel accurately from a given point. Table may be started or stopped at the master switch or from stations on either side of bed; a hanging pear switch is provided for convenience in setting up. It acts as an inching control. A safety switch is provided to prevent table running off the track. Control obtained by the special system of driving and the magnetic feeds. The principle of the drive is the Ward-Leonard system of using a special motor-generator to supply current to an individual motor, the control of the latter being principally accomplished by manipulation of the fields of the former.

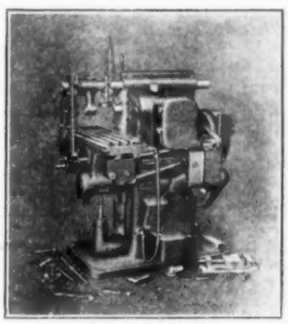


Milling Machine, Automatic

Brown & Sharpe Mfg. Co., Providence, R. I.

"American Machinist," March 25, 1920

Longitudinal feed, 22 in.; transverse adjustment, 6½ in.; vertical adjustment, 14½ in. Spindle: No. 10 taper; hole through ⅞-in.; pulley, 13 in.; hole through 5 hp. speed, 300 r.p.m.; sixteen spindle speeds, 28 to 695 r.p.m. either direction. Center of spindle to under side of arm 5¼ in.; greatest distance, face of column to arm braces, 16 in. Table: working surface, 34 x 11 in.; overall, 44 x 11 in. Feeds: Twelve 1.37 to 18.38 in. per minute; between cuts, 210 in. per minute. Cutter Lubrication: Tank capacity, 7-gal. Floor Space: 67 x 59½ in. Weights: Net, 3,350 lb.; ready for shipment, 3,775 lb.



Attachment, Prestometer

Coats Machine Tool Co., Inc., 110 West 40th St., New York, N. Y.

"American Machinist," March 25, 1920

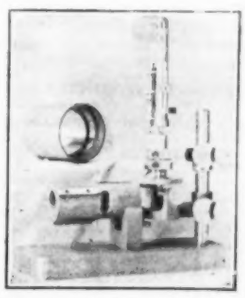
Used for gaging bores of Hoffman ball races. Nose of anvil block will accommodate races of one diameter only, interchangeable blocks used for races of different diameters. The gaging point, indicated by pencil, is connected to instrument contact-point by floating lever. Gage readings will show if hole is bell-mouthed, taper, oval or out of parallel. Limits on this work are very close (+ 0.0002) (—0.0001), a glass having a very small bore is used for indicating fluid, giving magnification of 3,000 diameters. Graduated scale is 3 in. long, graduations are 0.30 apart, each representing a 0.0001-in. variation in diameter of piece being gaged.

Attachment, Prestometer

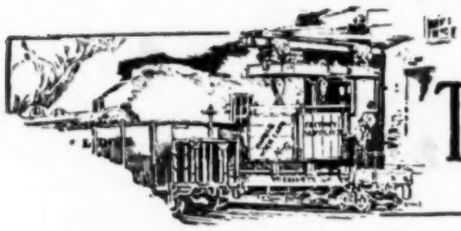
Coats Machine Tool Co., Inc., 110 West 40th St., New York, N. Y.

"American Machinist," March 25, 1920

Is intended for gaging pinion-shaft housings. Is provided with two contact points, each of which is connected by a floating lever to contact point of the instrument. Advantage of this arrangement is that it enables internal gaging to be done in a manner that has probably not been before attempted, in that internal stepped diameters can be accurately gaged even though they are not concentric either with each other or with the outside of the work.



Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	$44.60	$44.60
Northern Basic	42.80	42.80
Southern Ohio No. 2	43.80	43.80
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	48.65	47.65
Southern No. 2 (Silicon 2.25 to 2.75)	47.70	47.70
BIRMINGHAM		
No. 2 Foundry	41.00	41.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25–2.75 sil.	45.35–45.65*	45.35–45.65*
Virginia No. 2	44.25*	43.25*
Basic	43.00†	43.00†
Grey Forge	42.50*	42.50*
CHICAGO		
No. 2 Foundry local	43.25	43.25
No. 2 Foundry, Southern	46.60	46.60
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	43.65	43.65
Basic	42.90	42.90
Bessemer	43.40	43.40
MONTREAL		
Silicon 2.25 to 2.75%	43.25	43.25

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.97	$3.47	$3.47	$5.50	$3.37	$3.97	$3.47
Soft steel bars	4.12	3.52	3.37	5.00	3.27	3.87	3.37
Soft steel bar shapes	4.12	3.52	3.37		3.27	3.87	3.37
Soft steel bands	5.32	4.22	4.07	6.25			
Plates, ¼ to 1 in. thick	4.17	3.67	3.67	5.00	3.57	4.17	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.90
Warehouse, New York	4.57	4.17
Warehouse, Cleveland	3.42	3.82
Warehouse, Chicago	3.52	4.10

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55–4.00	7.00@8.00	4.57	7.30	6.02
No. 12	3.60–4.05	7.05@8.05	4.62	7.40	6.07
No. 14	3.65–4.10	7.10@8.10	4.67	7.45	6.12
No. 16	3.75–4.20	7.20@8.20	4.77	7.55	6.22
Black					
Nos. 18 and 20	4.15–4.80	7.80@8.80	5.42	7.95	6.80
Nos. 22 and 24	4.20–4.85	7.85@8.85	5.47	8.00	6.85
No. 26	4.25–4.90	7.90@8.90	5.52	8.05	6.90
No. 28	4.35–5.00	8.00@9.00	5.62	8.15	7.00
Galvanized					
No. 10	4.70–6.00	8.50@10.00	5.97	8.50	7.15
No. 12	4.80–6.10	8.60@10.10	6.02	8.60	7.20
No. 14	4.80–6.10	8.60@10.10	6.07	8.60	7.35
Nos. 18 and 20	5.10–6.40	8.90@10.40	6.37	8.90	7.65
Nos. 22 and 24	5.25–6.55	9.05@10.55	6.52	9.05	8.05
No. 26	5.40–6.70	9.20@10.70	6.67	9.20	8.20
No. 28	5.70–7.00	9.50@11.00	6.97	9.50	8.50

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled. **Automobile sheets are unavailable except in fugitive instances, when prices range to 15c per lb.**

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$6.00	$5.40	$5.50
Flats, square and hexagons, per 100 lb. base	6.50	5.90	5.50–6.00

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	55
Cleveland	50
Chicago	50

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$21.00–26.00	$25.50–30.00
Cleveland	20.00	20.00
Chicago	21.00	16.50

In coils an advance of 50c. usually is charged. Domestic iron (Swedish analysis) is selling at 12c. per lb.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire		Cast-Iron Welding Rods	
¼, 11, 5/16, ⅜, 7/16, ½, No. 8, 9/16 and No. 10	21.00 to 30.00	3/16 by 12 in. long	14.00
		¼ by 19 in. long	12.00
⅝		⅜ by 19 in. long	10.00
No. 12		½ by 24 in. long	10.00
7/16, No. 14 and 9/16		Special Welding Wire, Coated	
No. 18		¼	33.00
No. 20		5/16	30.00
Domestic 10c. for 7/16, 8c. for ⅜ to ½		½	38.00

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	8.00	8.00	9.00
Spring steel (light)	8.90	11.00	12.25
Coppered bessemer rods	8.00	8.00	7.35
Hoop steel	5.57	6.50	5.32
Cold-rolled strip steel	11.50	8.25	10.00
Floor plates	6.55	6.00	6.52

PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card, discounts on steel pipe, applying as from January 14, 1920, and on iron pipe from January 7, 1920.

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
⅛, ¼ and ⅜	47%	20%	¾ to 1¼	34%	18%
½	51%	36%			
¾	54%	41%			
1 to 3					

LAP WELD

2	47%	34%	2	28%	14%
2½ to 6	50%	37%	2½ to 6	30%	17%

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅛, ¼ and ⅜	43%	25%	¾ to ½	34%	19%
½	48%	35%			
¾ to 1¼	52%	39%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45%	33%	2	29%	16%
2½ to 4	48%	36%	2½ to 4	31%	19%
4½ to 6	47%	35%	4½ to 6	30%	18%

Stock discounts in cities named are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅛ to 3 in. steel butt welded	40%	24%	40%	31%	54%	40%
2½ to 6 in. steel lap welded	35%	20%	42%	27%	50%	37%

Malleable fittings, Class B and C, banded, from New York stock sell at plus 23%. Cast iron, standard sizes, net.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	19.00	19.00	15.37½
Tin in 5-ton lots	63.00	60.00	72.50
Lead	9.00	8.75	5.25
Spelter	8.75	9.55	6.55
ST. LOUIS			
Lead	8.75	8.375	5.00
Spelter	8.50	9.225	6.20

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

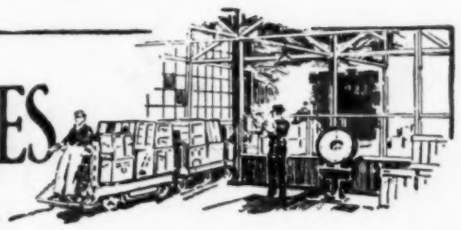
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	29.50	29.50	22.50	31@32	24.50	36.00	35.00
Copper wire (carload lots)	29.25	29.25	23.00	29.50	23.00	27.00	34.00
Brass sheets	26.50	26.50	18.75	29.00	25.00	27.00	35.00
Brass pipe	32.00	32.00	28.00	34.00	33.00	35.00	41.00
Solder (half and half) (case lots)	39.00	39.00	46.50	40.50	41.50	38.00	48.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	23.75	18.00
New York	23.75	19.50
Cleveland	27.00	24.00
Chicago	26.00	24.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f.o.b. mill 12.00

	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.00	14.45	15.50	14.80
New York	14.00	12.00	14.50	13.00
Chicago	15.00	16.50	15.00	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	10.75	7.50
Chicago	11.50	7.75
Cleveland	13.00	9.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York		Cleveland		
	Current	One Year Ago	Current	One Year Ago	Chicago
Copper, heavy, and crucible	16.50@17.25	13.00	17.00	14.00	17.25
Copper, heavy, and wire	15.75@16.00	12.00	17.00	13.00	16.25
Copper, light, and bottoms	14.50@17.50	10.50	15.50	11.00	15.25
Lead, heavy	7.75@ 8.00	4.25	8.50	4.50	7.75
Lead, tea	5.75@ 6.00	3.50	5.50	3.50	6.75
Brass, heavy	9.50@10.00	7.50	13.50	9.00	17.00
Brass, light	9.00@ 9.26	6.00	10.50	6.50	10.50
No. 1 yellow brass turnings	8.75@ 9.25	7.00	10.75	7.00	10.75
Zinc	5.25@ 5.75	4.50	6.00	4.00	6.50

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	33.00	34.00c.@35.00c.	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	33.00	25.00
Chicago	29.00	28.00
Cleveland	32.00	28.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	87.00	74.50	79.00	70.00	75.00
Commercial	50.00	42.00	21.50	18.50	15.00	15.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$3.00	.25	$1.00	$1.90	$1.25	1.28
Hot pressed hexagon	+ 3.00	.25	1.00	1.90	1.25	1.08
Cold punched hexagon	+ 3.00	2.25	1.00	1.90	90	1.30
Cold punched square	+ 3.00	2.25	1.00	1.90	90	1.30

Semi-finished nuts, ⅝ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	40%	50-10%
Chicago	50%	50%
Cleveland	55%	60-10-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	20%	40+5%	35-5%
Larger and longer up to 1½ in. by 30 in.	10%	30%	25-5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York..... list Cleveland..... $3.75 Chicago..... $3.00

For cast-iron washers, ⅜ and larger, the base price per 100 lb is as follows:

New York..... $5.00 Cleveland..... $4.50 Chicago..... $4.25

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	20%	40%	30%
Larger and longer up to 1 in. by 30 in.	10%	20+10%	20%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	20%	30%	10%
Chicago	10%	10%	10%	20% from list
New York	10%	40% from list	10%	

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅜ and smaller	30%	45%	45%
Tinned	30%	45%	45%

Boiler, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$6.00 Cleveland...$4.00 Chicago....$5.37 Pittsburgh...$4.72

Structural, same sizes:

New York...$6.10 Cleveland...$4.10 Chicago....$5.47 Pittsburgh....$4.82

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	34.00	36.00	35.00
Brass	33.00	34.00	34.00

For immediate stock shipment 3c. is usually added. The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 2c.; for lots of less than 75 lb., but not less than 50 lb. advance is 5c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb. 10c. should be added to base price; quantities from 10-25 lb., extra is 25c.; less than 10 lb., add 35c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ¼-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $8.50 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	New York		Cleveland	Chicago
	Current	One Year Ago		
White	13.00	13.00	16.00	11.00 to 14.00
Colored mixed	9.00 to 12.00	9.00-12.00	12.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	52.00	58.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.25	$2.25	$1.75
Philadelphia	2.00	2.00	1.75
Cleveland	2.50	2.50	2.75
Chicago	2.25	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.40	$3.40	$3.65
Cleveland	4.25	4.25	3.62
Chicago	5.00	5.00	4.125

COKE—The following are prices per net ton at ovens, Connellsville:

	Apr. 1	Mar. 25	Mar. 18	Mar. 11
Prompt furnace	$6.00	$6.00	$6.00	$6.00
Prompt foundry	7.00	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

	New York			Chicago	
	Current	One Year Ago	Cleveland	Current	One Year Ago
Raw in barrels (5 bbl. lots)	$1.87	$1.55	$2.08	$2.05	$1.66
5-gal. cans (without cans)	1.87*	1.70	2.25	2.30	1.86

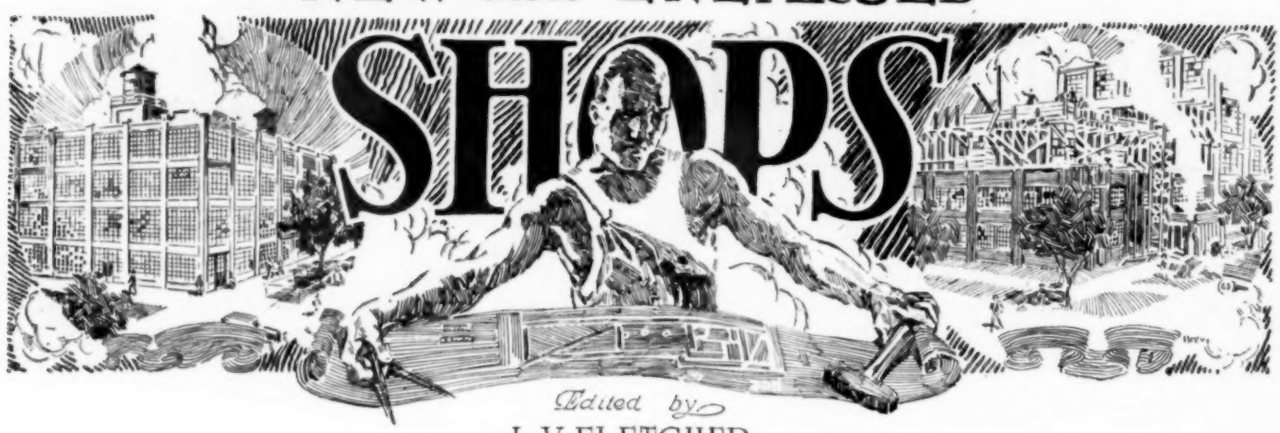
*To this *oil* price must be added the cost of the cans (returnable), which is $2.25 for a case of six.

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	15.50	17.00	13.00	14.50	15.50	13.00
25 and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25
12½-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00

500 lb. lots less 10% discount. 2000 lb. lots less 10-2½% discount.

NEW *and* ENLARGED



Edited by
L·V·FLETCHER

Machine Tools

The following concerns are in the market for machine tools.

Conn., Bridgeport—The Amer. & British Mfg. Co., 718 Crescent Ave.—Racine high speed hacksaw. Double gear shaper and generator, 6-11-20 in., Gleason make preferred. "Browning" double gear shaper.

Conn., Bridgeport—Schwab & McMellon, 166 Elm St.—one small vertical milling machine, "Becker" preferred.

Conn., Hartford—T. Mahan, 36 Elm St.—auto repair equipment.

D. C., Washington—The Service Radio School, 900 Pennsylvania Ave.—1 Rivett 9 in. precision lathe, 1 Henry & Wright or similar sensitive drill press.

Md., Baltimore—L. Blaustein, 612 Water St.—equipment for automobile repair work.

Md., Baltimore—The Harvey Co., 113 South St.—vertical boring and turning mill, motor or belt driven. 84 in. Lathe, motor or belt driven. 72 in. Lathe, motor or belt driven (new or used).

N. J., Bloomfield—The Spaulding Chain Corp.—power (link) punches, automatic screw machines.

N. J., Camden—The W. L. Hurley Co., 91 East Commerce St.—auto repair equipment.

N. J., Constable—The Bethlehem Steel Co.—One Pitman lathe, 42 in. x 19 ft. geared head. One prentice lathe, 16 in. x 8 ft. geared head. One 32 in. heavy duty Cincinnati shaper. One 5 ft. Cincinnati Bickford radial drill. One 31 in. Rockford upright drill. One Springfield type B. M. double end motor driven grinder, all for 220 volt, 2 phase, 60 cycle current.

N. J., Newark—Baker & Co., 54 Austin St.—auto repair equipment.

N. J., Newark—J. Salkalin, 197 South 13th St.—Auto repair equipment.

N. Y., Buffalo—The Kam Kaderback Co., Inc., 1120 Main St.—garage and automobile repair equipment.

N. Y., Buffalo—The Mollenberg Betz Machine Co., 110 Washington St.—7 ft. vertical boring mill.

N. Y., Buffalo—The Newman Machinery Sales Co., 231 Niagara St.—General machine shop eqpipment, including planer, lathes, drilling machines, boring machines and shaper.

N. Y., Buffalo—The G. A. Wray Mfg. Co., 1495 Niagara St.—one 30 to 36 in. square shear, one 15 in. drill press.

N. Y., New York (Borough of Brooklyn)—The Eismann Magneto Co., 32 33rd St.—one 24 x 24 x 6 ft. planer.

N. Y., New York (Borough of Manhattan)—The Amer. Manufacturers' Export Association, 160 Broadway—electric and pneumatic drills; Boyer rivet "guns"; general ship-yard equipment for export.

N. Y., New York (Borough of Manhattan)—The Distinctive Jewelry Co., 302 West 36th St.—small millers with vertical attachment; surface grinder; sensitive drill presses.

N. Y., Schenectady—The General Electric Co., River Rd., for Bridgeport, Conn., plant—Two 9 in. Standard Porter cable lathes complete with drawn collets. One 4 ft. heavy duty radial drill press with tapping attachment. Two 3½ ft. Carleton sensitive radial drill presses with table on bed. One 4 spindle, heavy type Henry & Wright sensitive drill presses with 12 in. overhang. Three 4 spindle, Henry & Wright, or Allen, sensitive drill presses. One 24 in. heavy duty Cincinnati plain vertical miller. Four No. 3 Cincinnati plain horizontal millers. One No. 12 double spindle P. & W. profiler. One No. 1½ Racine high speed hacksaw. One No. 2 Gardner disc grinder with 14 in. perfection ring wheel chucks.

For Schenectady plant—One inserted tooth grinder, motor drive. Thirteen No. 2 bench presses, equivalent to No. 2 Niagara. Two inclinable punch presses, one equivalent of Bliss No. 19, one of Bliss No. 20. One 16 in. x 6 ft. engine lathe with compound rest, taper attachment, and draw back chuck mechanism, single pulley drive. One 16 in. shaper. One No. 2 Universal miller. One 15 in. over-hang sensitive drill press. One ring and circle shear, 6 ft. to 60 in.

For Pittsfield, Mass., plant—Two single spindle drill presses equipped with table which can be moved in any direction, and swung about column, capacity to 1 in. One Universal shaper, without power rotary feed, motor and swivel vise, but with circular planing attachment, and index centers. Equivalent of Porter & Johnson No. 15. One 16 in. engine lathe with taper, and "Type D" relieving attachment. One 10 x 50 in. plain grinder. One 18 in. 8 ft. engine lathe. One 24 in. x 10 ft. engine lathe, all machines arranged for motor drive.

N. Y., Syracuse—J. H. Martley, 1012 West Genesee St.—lathe, miller shaper and drill press.

N. Y., Watertown—Bell & Pound, 341 State St.—tool room lathe.

N. Y., Watertown—C. Gray, 335 State St.—power grinder.

Pa., Philadelphia—The Keystone Auto Truck Co., 16th and Glenwood Sts.—machine tools.

Fla., Jacksonville—The Merrill Stevens Shipbuilding Co.—One 72 in. lathe, motor drive. One drivewheel lathe, 72 or 84 in.

Ill., Altona—The Illinois Glass Co.—one 42 in. heavy duty lathe, 12 ft. bed, 5 ft. 9¼ in. between centers, motor drive (new or used).

Ill., Chicago—Morris & Co., Union Stock Yards—threading machine, 1¼ in. capacity (new or used).

Ill., Chicago—Simonson Koons, 8 North Plaines St.—36 x 36 x 12—2 or 3 head planer.

Mich., Detroit—P. Backer, 2200 West Grand Blvd.—lathe, 14 in; drill press.

Mich., Detroit—The Ewing Bolt and Screw Co., 403 Farwell Bldg.—general equipment for the manufacture of screws, bolts, nuts and rivets.

Mich., Detroit—The Fruchey Machine Co., 54 East Lafayette Ave.—drill press and threading machine.

Mich., Detroit—S. B. and B. Machine Co., 45 East Fort St.—1 shaper.

Mich., Detroit—Waisman Bros., 140 East Canfield St.—tools for automobile repair shop.

Mich., Flint—The Dort Motor Co.—machine shop equipment.

Mich., Kalamazoo—The Handley Knight Co.—machine tools and mechanical equipment for finishing and assembling automobiles.

Mich., Pontiac—The General Motors Truck Co.—general machine shop equipment for making and assembling motor trucks.

Mich., Port Huron—The Mueller Metals Mfg. Co., Lapeer Ave.—automatic screw machine, and equipment for making die castings.

Mich., St. Louis—The Trione Piston Ring Co.—screw machines and piston ring grinder.

O., Cleveland—Bd. Educ., F. S. Hogan, Dir.—presses, lathes.

Wis., Milwaukee—The Milwaukee Ice Machine Co., 1001 Cold Spring Ave.—2 lathes.

Kan., Kansas City—The 13th St. Garage, 13th St. and Minnesota Ave—one 16 in. x 8 ft. engine lathe.

Minn., Duluth—The M. A. Hanna & Co., Leader-News Bldg.—One 20 in. drain, 2½ in. face wet tool grinder. One 3 in. single head bolt cutter. One 5 ft. plain radial drill. One 30 in. x 30 in. x 9 ft. single head planing machine. One 20 in. vertical plain power feed drill press. One 18 in. x 12 ft. single back geared lathe. One 30 in. x 18 ft. double back geared lathe, compound rest, power cross feed, quick change gears. All belt driven. (New.)

Minn., St. Paul—The Great Northern R.R., 175 East 4th St., Purchasing Dept.—One 90 in. drive wheel lathe. One 44 in. vertical boring mill. One 30 in. x 30 in. x 6 ft. planer. One 20 in. x 12 ft. engine lathe. One 20 in. hign duty snaper with tapping attachment. One twist grill grinder, complete. One 2 in. double bolt cutter, complete. One ¼ in. to 4 in. pipe threading machine. One 125 ton Watson or similar driving box press. One double end punch and shear, ¾ in. plate capacity. One 6 x 62 in. hand operated bending roll. One 46½ in. H. & A. alligator shear. One 600 lb. single frame steam hammer. One Whiting 2 motor electric overhead traveling crane, 5 ton, 36 ft. span, with 3 phase, 60 cycle, 440 volt, a.c. motor (new).

Mo., Kansas City—The Shone & Johnson Machine Shop, 215 Kansas City Ave.—one 16 in. x 10 ft. engine lathe.

Mo., Kansas City—The Witte Engine Works—one 4 spindle drill with capacity up to ¾ or ¾ in. (new).

Neb., Grand Island—Teeter & Hamair—machine tools for auto repair and service department.

Tex., Houston—The Reed Roller Bit Co., 3602 Harrisburg Blvd.—general machine tools

Machinery

The following concerns are in the market for machinery.

Conn., Bridgeport—The Amer. Tube and Stamping Co., 471 Hancock Ave.—3 Bliss inclinable power presses.

Conn., Bridgeport—The Arrow Tool Co., 200 Cannon St.—one medium size power press.

Conn., Bridgeport—The Columbia Graphophone Mfg. Co., West Plant—10 hydraulic presses, 95 ton (Watson & Stillman make).

Mass., Boston—The Boston Elevated Ry. Co., 101 Milk St.—woodworking machinery.

Mass., Fall River—The Amer. Thread Co.—spinning and special machinery.

N. Y., Buffalo—The Buffalo Auto Radiator Co., 1180 Main St.—1 light power punch press.

N. Y., Evans Mills—The F. V. Baumert Co., Antwerp—milk handling machinery and equipment.

N. Y., Union—The Union Milling Co.—grain milling machinery.

Pa., Oaklane (Philadelphia P. O.)—The Elwood Ivins Tube Works—automatic cutting machine.

Pa., Philadelphia — The International Tire Co., Broad and Cumberland Sts.—machinery for the manufacture of tire tubes.

Pa., Williamsport — The Williamsport Wire Rope Co.—new equipment for the manufacture of wire rope.

Ill., Chicago—The Art Metal Radiator Cover Co., 133 West Washington St.—8 or 10 ft. power shears and power brake.

Ill., Chicago—The Athey Co., 124 West 24th St.—power punch presses to work ¾ in. hole in ½ to ⅝ in. soft steel stock.

Ill., Chicago—The S. Buchsbaum Co., 5430 South Michigan Ave.—general jewelry working equipment, small lathes, punch presses, etc.

Ill., Chicago—The Oxweld Acetylene Co., Jasper Place and 36th St.—1 No. 5 consolidated inclinable power press, flywheel type.

Ill., Chicago—The Parke Auto and Machine Co., 661 East 63rd St.—No. 21 Bliss punch press, or equivalent.

Ill., Chicago—The E. H. Stafford Mfg. Co., 218 South Wabash St.—40 or 42 in. double disc sanding machine.

Ind., Indianapolis—The Capitol Drop Forge Co., 953 Harrison St.—one 1,000 lb. board drop hammer, one shear to cut ⅞ in. steel, 3½ in. wide. (new).

Mich., Detroit—A. Kahn, Marquette Bldg.—electric cranes and carriers for machine and press shops.

Mich., Detroit—W. W. Kernan, 17 John R St.—paper cutting machines and squaring shears.

Mich., Detroit—Square D Co., 1400 Rivard St.—2 double crank presses, 36 in. between housings, one No. 168 Toledo toggle press 1 power squaring shear, for 12 ga. sheets to cut from 48-60 in. (new).

Mich., Detroit—The Vacuum Cup Hanger Co., 101 East Atwater St.—special machinery for making vacuum cup hangers.

Mich., St. Johns—St. Johns Industrial Foundry Co.—general foundry equipment.

O., Cleveland—The Fisher Body Co., Oakland and Piquette Aves., Detroit—complete mechanical equipment for press room, dry kilns and finishing department.

O., Cleveland—F. B. Stearns Co., 15830 So. Park Bldg.—power forging presses, auto body working equipment.

Wis., Jackson—The Jackson Canning Co.—canning machinery and conveyors.

Wis., Milwaukee—The Federal Cone and Candy Co., 100 George St.—candy making machinery.

Wis., Milwaukee—C. W. Ledebuhr, 1067 18th St.—combination saw with jointer and boring attachment and one single spindle shaper.

Wis., Milwaukee—The North Milwaukee Foundry Co., 698 28th St.—foundry equipment.

Wis., Oconomowoc—The Oconomowoc Canning and Products Co.—canning machinery and conveyors.

Mo., Kansas City—The Liberty Mfg. & Sales Co., 1109 East 15th St.—1 punch press with 10 x 10 in. tilting table, single crank, either Bliss or Consolidated.

Neb., Kearney—The C. M. Kuhns Co.—power presses.

Cal., San Bernardino—The W. J. Hanford Iron Works—one 5 ton traveling crane.

Ont., Ottawa—The Standard Bread Co., Oliver St.—bread, cake and candy machinery.

Metal Working

NEW ENGLAND STATES

Conn., Bridgeport—The General Electric Co., River Rd., Schnectady, N. Y., has purchased a munition plant here, and plans to remodel same for the manufacture of switchboards.

Conn., Harftord—F. D. Esops, 647 Main St., will soon award the contract for the construction of a 3 story, 58 x 102 ft. garage on Albany Ave. and Bedford St. Estimated cost, $70,000.

Conn., Hartford—T. Mahan, 36 Elm St., has had plans prepared by F. C. Walz, Archt., 348 Trumbull St., for the construction of a 1 story, 50 x 110 ft. garage on Windsor Ave.

Conn., Meriden—C. N. Flagg & Co., Inc., 27 State St., will soon award the contract for the construction of a 1 and 2 story, 41 x 120 ft. factory on Griswold St., for the manufacture of steam heating engines. Estimated cost, $35,000. Orr & Del Grella, 956 Chapel St., New Haven, Archts.

Conn., Meriden—The International Silver Co., 48 State St., has awarded the contract for the construction of two 1 story additions to factory on George St. Estimated cost, $40,000.

Conn., New Britain—A. G. Hawker, 8 Elm St., has awarded the contract for the construction of a 1 story, 55 x 100 ft. garage. Estimated cost, $30,000. Noted March 4.

Conn., New Britain—The Russell & Erwin Mfg. Co., Washington St., is having plans prepared by P. Sellers, Archt., 207 Orange St., New Haven, for the construction of a factory for the manufacture of locks and hardware.

Conn., New Haven—H. B. Ives & Co., 5 Artzan St., manufacturer of builders hardware, will soon award the contract for the construction of a large addition to its plant.

Conn., New Haven—The L. C. Realty Co., 166 Brewery St., has awarded the contract for the construction of a 1 story, 50 x 175 ft. and 19 x 40 ft. garage on Whalley Ave. Estimated cost, $30,000.

Conn., Plainville—Peck Spring Co., 68 Broad St., manufacturer of hair springs, plans to construct an addition to its plant. Estimated cost, $25,000.

Conn., South Manchester—The Stephens & Williams Auto Co., 361 Center St., will build a 1 story, 80 x 195 ft. garage and showroom on East Center St. Estimated cost, $60,000.

Conn., South Norwalk — Riccio & Bro., Woodward Ave., are having plans prepared for the construction of a 1 story, 100 x 100 ft. garage on Woodward Ave. and Cross St. Estimated cost, $40,000.

Conn., Wallingford — The Dowd-Rodgers Co., Carleton St., plans to build a 3 story, 50 x 100 ft. factory, on South Cherry St., for the manufacture of silver plate ware.

Conn., Willimantic—S. Parcaro, 22 Union St., will soon award the contract for the construction of a 2 story, 90 x 90 ft. garage on Temple St. Estimated cost, $45,000.

Mass., Athol—The Union Twist Drill Co. is having plans prepared by Frost & Chamberlain, Archts., Slatee Trust Bldg., Worcester, for the construction of a 4 story, 60 x 200 ft. factory. Estimated cost, $150,000.

Mass., Atlantic — Bureau of Yards & Docks, Navy Dept., Wash., D. C., plans to remove machine shop and boiler shop annex from Quincy to here. Estimated cost, $50,000.

Mass., Boston—The Bethlehem Shipbuilding Corp., Fore River, will soon award the contract for the construction of a 2 story, 50 x 220 ft. shop.

Mass., Brookline—The Metropolitan Coal Co., 20 Exchange St., Boston, is having plans prepared by W. M. Bacon, Archt., 27 Kilby St., Boston for the construction of a 2 story, 30 x 90 ft. garage on Reservoir St., here. Estimated cost, $25,000.

Mass., Everett (Boston P. O.)—The Sexton Can Co., 228 Franklin St., Boston, has awarded the contract for the construction of a 3 story, 80 x 121 ft. factory on Cross and Alfred Sts. Estimated cost, $120,000. Noted April 1.

Mass., Holyoke—The Lachapelle Bourger Co. has awarded the contract for the construction of a 3 story, 55 x 100 ft. garage on Main St. Estimated cost, $120,000.

Mass., Springfield—The Gardner Garage Co., 425 St. James Ave., plans to build a 1 story garage on State St. Estimated cost, $100,000.

Mass., Springfield — The Storms Drop Forging Co., 168 Bridge St., has awarded the contract for the construction of a 1 story, 70 x 160 ft. forge plant on Cottage St. Estimated cost, $36,000. Noted March 18.

Mass., Springfield—The Western Massachusetts Cadillac Co., Inc., 521 Worthington St., has awarded the contract for the construction of a 1 and 2 story service station and salesroom. Estimated cost, $50,000.

Mass., Westfield—The Westfield Mfg. Co., Cycle Ave., manufacturers of bicycles and motorcycles, will soon award the contract for the construction of a 2 story, 65 x 102 ft. addition to its plant. Estimated cost, $35,000. M. B. Harding, 33 Elm St., Archt.

Mass., Wollaston—The Tubular Stud and Rivet Co. has awarded the contract for the construction of a 3 story, 94 x 297 ft. and 40 x 270 ft. addition to its plant.

R. I., Providence—The Chandler Motor Co., of Rhode Island, 212 Broad St., has awarded the contract for the construction of a 1 story, 90 x 100 ft. garage and service station, on Pearl St. Estimated cost, $35,000. Noted March 11.

R. I., Providence — L. E. Danforth, 76 Dorrance St., will soon award the contract for the construction of a 1 story, 100 x 200 ft. garage and service station. Estimated cost, $80,000. Tuck & Gilman, 34 School St., Boston, Mass., Archts.

R. I., Providence — Diamond Co., 325 Fountain St., plans to construct a 1 story, 50 x 140 ft., garage on Battery St. Estimated cost, $25,000.

R. I., Providence—C. A. Potter, Crary St., plans to construct a 1 story, 40 x 135 ft., garage on Bridgman St. Estimated cost, $25,000.

MIDDLE ATLANTIC STATES

Del., Wilmington—Packard Motor Agency, 223 West 9th St., will soon award the contract for the construction of a 1 story, 55 x 140 ft. service and sales building. Estimated cost, $10,000. P. S. Tyre, 1509 Arch St., Philadelphia, Archt. and Engr.

Md., Baltimore— L. Blaustein, 612 Water St., will soon award the contract for the construction of a 2 story, 57 x 130 ft. garage at 609 North Fremont Ave. Estimated cost, $40,000. G. R. Callis, 611 Amer. Bldg., Archt.

Md., Baltimore—The Maryland Casualty Co., Baltimore St. and Guilford Ave., will soon award the contract for the construction of a plant on 40th St. and Cedar Ave., to include a garage, power house, and printing shop, 1 story, 60 x 122 ft. each; also a 3 story, 300 x 300 ft. administration building. Estimated cost, $1,000,000. O. G. Simonson, c/o owner, Archt. Noted Sept. 25.

Md., Orangeville (Baltimore P. O.)—The Columbia Graphaphone Co., Woolworth Building, New York City, has awarded the contract for the construction of a plant to include a 6 story, 260 x 380 ft. cabinet factory, a 1 story, 85 x 100 ft. power house, a 1 story, 76 x 500 ft. dry kiln, and 10 mi. track connections from the plant to the Baltimore & Ohio and Pennsylvania Railroads. Estimated cost, $2,500,000.

N. J., Camden—The W. L. Hurley Co., 91 East Commerce St., has awarded the contract for the construction of a 1 story, 40 x 81 ft. garage on Pine St. and Broadway. Estimated cost, $15,000. Noted, Mar. 25.

N. J., Newark—The Arrow Motor and Machine Co., 307 Market St., has awarded the contract for the construction of a 2 story, 20 x 70 ft. and a 1 story, 70 x 100 ft. plant, at 727 Frelinghuysen St. Estimated cost, $60,000.

N. J., Newark—Baker & Co., 54 Austin St., has awarded the contract for the construction of a 1 and 2 story, 33 x 38 ft., 38 x 50 ft. and 14 x 18 ft. garage and carpentershop. Estimated cost, $43,000.

N. J., Newark—The Koplin Motor Sales Co., 486 Central Ave., will soon award the contract for the construction of a 1 story, 100 x 112 ft. garage and salesroom on Frelinghuysen and Clifton Sts. Estimated cost, $30,000. F. Grad, Amer. Natl. Bank Bldg., Archt.

N. J., Newark—The Mono Service Co., Verona and Oraton Sts., has awarded the contract for the construction of a 2 story, 103 x 175 ft. factory for the manufacture of paper containers.

N. J., Newark—J. Salkalin, 197 South 13th St., will soon award the contract for the construction of a 1 story, 50 x 112 ft. garage at 15 South 14th St. Estimated cost, $15,000. M. B. Sillerstein, 119 Springfield Ave., Archt.

N. Y., Batavia—W. J. Goade, manufacturer of hardware, etc., plans to build an addition to his factory on Ellicott St. Estimated cost, $25,000.

N. Y., Binghamton—The Brewer Titchener Corp., Court St., manufacturer of carriage and auto hardware, has awarded the contract for the construction of a 1 and 2 story, 144 x 200 ft. factory. Estimated cost, $100,000.

N. Y., Buffalo—The Sowers Mfg. Co., 1300 Niagara St., plans to alter and build addition to its machine shop and foundry. Estimated cost, $100,000.

N. Y., Coney Island—Seeling & Finkelstein, Engrs. and Archts., 26 Court St., Brooklyn, are preparing plans for the construction of a 2 story, 100 x 200 ft. garage, on Neptune Ave. and West 1st St. Estimated cost, $40,000. Owners name withheld.

N. Y., Johnson City—The Sweet Bros. Foundry Co. plans to build a 1 story, 160 x 200 ft. foundry on Grand Ave. Cost between $60,000 and $70,000.

N. Y., Newton Falls—The Newton Falls Paper Co. will build a 1 story, 103 x 270 ft. machine shop. Cost, between $75,000 and $85,000. T. L. Moore, Pres. Noted Mar. 25.

N. Y., New York (Borough of Brooklyn)—The Amer. Numbering Machine Co., 226 Shepherd Ave., has awarded the contract for the construction of a 2 story, 50 x 100 ft. factory and garage on Atlantic Ave. Estimated cost, $40,000.

N. Y., New York (Borough of Brooklyn)—The Battle Iron Truck Co., 44 Court St., has awarded the contract for the construction of a 5 story, 100 x 100 ft. garage on 57th and 11th Ave. Estimated cost, $250,000.

N. Y., New York (Borough of Brooklyn)—H. Figge, 285 Atlantic Ave., will build a 4 story garage on Pacific St. Estimated cost, $60,000. Noted Feb. 26.

N. Y., New York (Borough of Brooklyn)—Maxwell & Son, 295 Park Ave., have awarded the contract for the construction of a 2 story, 50 x 125 ft. factory, on Sand and Adams Sts., for the manufacture of bird cages. Estimated cost, $35,000.

N. Y., New York (Borough of Brooklyn)—The Mordy Constr. Co., 690 Broadway, will build a 1 story, 100 x 100 ft. garage on 39th St. Estimated cost, $30,000.

N. Y., New York (Borough of Brooklyn)—I. Rockford, c/o A. J. Halpin, 41 Park Row, New York City, will build a 1 story garage and showroom on Crown St. and Bedford Ave. Estimated cost, $60,000.

N. Y., New York (Borough of Brooklyn)—A. Rockmore, 50 Court St., will build a 1 story, 50 x 180 ft. addition to his garage, on Berger St. Estimated cost, $25,000.

N. Y., New York (Borough of Brooklyn)—Rothfeld & Bernstein, c/o Brook & Sackheim, Archts., 215 Montague St., will build a 1 story, 100 x 100 ft. garage on Hope and Rodney Sts. Estimated cost, $40,000.

N. Y., New York (Borough of Brooklyn)—A. Schwartz, c/o M. Hirsch, Archt., 215 Montague St., will build a 1 story, 100 x 250 ft. garage. Estimated cost, $100,000.

N. Y., New York (Borough of Brooklyn)—The Self-Winding Clock Co., Grand and Willoughby Aves., will alter its factory. Estimated cost, $100,000.

N. Y., New York (Borough of Manhattan)—J. Massininni, c/o E. Wilbur, Archt., 507 5th Ave., is having plans prepared for the construction of a 1 story, 50 x 150 ft. garage on 162nd St. Estimated cost, $35,000.

N. Y., New York (Borough of Queens)—The Fahnestock Electric Co., Skillman Ave., Long Island City, has awarded the contract for the construction of a 2 story 50 x 100 ft. factory, on East Ave and 8th St. Estimated cost, $52,000.

N. Y., New York (Borough of Queens)—The New York and Queens Electric Light and Power Co., Bridge Plaza, Long Island City, has awarded the contract for the construction of a 5-story, 35 x 100 ft. garage on Hamilton Ave. Estimated cost, $25,000. Noted Mar. 4.

N. Y., Rochester—The General Electric Co., Granite Bldg., has purchased the munition plant of the Symington Machine Corp., on Crough St. and Leighton Ave., and plans to alter and use same for the manufacture of small electrical motors.

N. Y., Rochester—The Rochester Foundries, Inc., plans to purchase the foundry property of the F. L. Houghs Co., on South Ave., and will also build extensive additions to same. J. R. Dunn, 165 Barrington St., Dir.

N. Y., Utica—The International Heater Co., 21 Park Ave., has purchased the plant and property of the Utica Pipe Foundry, and plans to repair and improve same for its own use.

Pa., Connellsville—The Paragon Motor Co., 404 Century Bldg., Cleveland, O., is having plans prepared by F. F. Hockenthal, Engr., 404 Century Bldg., Cleveland, O., for the construction of a 1 story, 60 x 400 ft. and a 1 story, 40 x 500 ft. factory, here. Estimated cost, $500,000. J. F. Kurtz, Pres.

Pa., Lancaster—The Merchant & Evans Co., 2035 Washington St., has awarded the contract for the construction of a 1 story, 100 x 300 ft. factory for the manufacture of tin plate and metals.

Pa., Philadelphia—A. Hartman, c/o L. B. Rothschild, Archt., 1225 Sansom St., will build a 6 story, 56 x 125 ft. sales and service station, on 16th and Vine Sts. Estimated cost, $100,000.

Pa., Philadelphia—The Keystone Automobile Top Co., 1412 Fairmount St., will soon award the contract for the construction of a 4 story, 80 x 140 ft. factory, on Fairmount and 17th Sts. Noted March 11.

Pa., Philadelphia—F. J. Stokes, 17th and Cambria Sts., has awarded the contract for the construction of a 1 story, 90 x 160 ft. machine shop on Tabor Ave. and Perry St. Estimated cost, $50,000.

Pa., Philadelphia—The Universal Motor Agency, 3438 Ludlow St., has awarded the contract for the construction of a 2 story, 74 x 214 ft. service station, on 34th and Chestnut Sts. Estimated cost, $50,000.

Pa., Titusville—The Odin Construction Co., manufacturer of oil tanks, plans to build an addition to its plant on South Monroe St. Estimated cost, $25,000. L. T. Fulton, 426 Drake St., Pres.

Pa., Torresdale—The Precision Grinding Wheel Co. has awarded the contract for the construction of a 1 story, 90 x 265 ft. factory. Estimated cost, $100,000.

Pa., Wheatland—The Slick Knox Steel Co. is preparing plans for a 1 story steel mill, to be 500 ft. long. Estimated cost, $300,000. W. L. Ulmer, Hippodrome Bldg., Cleveland, O., Dir.

Pa., Williamsport — The Williamsport Wire Rope Co. has awarded the contract for the construction of a 1 story, 100 x 340 ft. factory.

SOUTHERN STATES

Ky., Louisville—W. E. Ross, 1123 Cherokee Rd., is having plans prepared by Gaffney & Epping, Archts. and Engrs., Louisville, for the construction of a 5 story, 90 x 120 ft. garage, at 2-3 Market St. Estimated cost, $100,000.

N. C., Greensboro—The Master Auto Service Co. is having plans prepared by A. Worth, Archt., Greensboro, for the construction of a 2 story, 55 x 150 ft. garage. Estimated cost, $50,000.

N. C., Raleigh—J. R Rogers has awarded the contract for the construction of a 3 story, 50 x 100 ft. garage. Estimated cost, $100,000.

S. C., Greenville—J. C. Redmond is building a 1 story, 45 x 84 ft. garage on Coffee St. Estimated cost, $15,000.

MIDDLE WEST

Ill., Chicago—The D. O. James Mfg. Co., 1120 West Monroe St., is having plans prepared by Ronneberg & Pierce, Archts., 10 South La Salle St., for the construction of a 3 story, 48 x 120 ft. factory for the manufacture of gears. Estimated cost, $50,000.

Ill., Chicago—The Northern Drop Forge Co. plans to build a plant in the tract bounded by Duke, James, Oneida and Randolph Sts. Estimated cost, $150,000.

Ind., Indianapolis—The Craig Hunt Motors Co., 9 North Illinois St., plans to build a factory on 38th and Merdian Sts. Estimated cost, $300,000.

Mich., Detroit — The Cable Draper Co., Vermont and Marquette Aves., will soon award the contract for the construction of a 2 story, 90 x 150 ft. garage on Vermont and Ferry Park Aves. Estimated cost, $40,000. Pollmar & Ropes, 45 State St., Engrs. and Archts. Noted April 1.

Mich., Detroit — The Ewing Bolt and Screw Co., 403 Farwell Bldg., plans to build a 1 story factory. Estimated cost, $350,000.

Mich., Detroit—Waisman Bros., 140 East Canfield St., will soon award the contract for the construction of a 2 story, 62 x 150 ft. garage. Estimated cost, $40,000. A. Clubb, Goebel Bldg., Archt.

Mich., Detroit — F. J. Whitney, 1443 Grand River Ave., has awarded the contract for the construction of a 1 story, 200 x 250 ft. garage on Franklin St. Noted Dec. 11.

Mich., Flint—The Dort Motor Car Co. plans to build a 3 story machine shop on Western Rd. Estimated cost, $100,000. Smith, Hinchman & Grylls, 710 Washington Arcade, Detroit, Archts.

Mich., Kalamazoo—The Handley Knight Co. has awarded the contract for the construction of a 3 story, 80 x 800 ft. factory, along the tracks of the Lake Shore and Grand Trunk Railways, for the manufacture of automobiles.

O., Cincinnati—The E. H. Bardes Range Co., 2619 Colerain Ave., has awarded the contract for the construction of a 2 story, 85 x 102 ft. factory. Noted Jan. 8.

O., Cincinnati—The Edna Brass Works, Reading Road, is having plans prepared by the Reliance Engineering Co., 4th Natl. Bank Bldg., for the construction of a 1 story, 50 x 100 ft. foundry. Estimated cost, $10,000.

O., Cincinnati—The MacLeod Co., Bogen St., machine specialists, has awarded the contract for the construction of a 3 story, 28 x 60 ft. factory. Estimated cost, $12,000. Noted Feb. 26.

O., Cleveland — The Bissinger Magneto Co., 2353 Euclid Ave., has awarded the contract for the construction of a 2 story, 120 x 134 ft. garage on East 21st St. and Chester Ave., to include a work shop and office. Estimated cost, $60,000. Noted Jan. 15.

O., Cleveland — The Collinwood Foundry Co., 17004 Waterloo Rd., has awarded the contract for the reconstruction of a 1 story, 60 x 200 ft. foundry. Estimated cost, $50,000.

O., Cleveland—Cuyahoga Foundry Co., c/o F. Hronek, Archt., 3608 East 131st St., will soon award the contract for the construction of a 1 story, 110 x 213 ft. foundry. Estimated cost, $100,000.

O., Cleveland — The Efficient Vise and Wrench Co., 4207 Clark Ave., has increased its capital stock from $50,000 to $500,000, and plans to build an addition to its plant.

O., Cleveland—R. M. Ewing, Williamson Bldg., has awarded the contract for the construction of a 1 story, 31 x 120 ft. machine shop at 1466 St. Clair Ave. Estimated cost, $10,000. Above shop to be leased.

O., Cleveland—The Fisher Body Co., Oakland and Piquette Aves., Detroit, has awarded the contract for the construction of a 7 story, 120 x 1,300 ft. factory on Coit Rd. here, for the manufacture of automobile bodies. Estimated cost, $6,000,000. Noted March 4.

O., Cleveland—The Green Rohn Realty Co., Sloan Bldg., has awarded the contract for the construction of a 2 story, 80 x 200 ft. garage on East 19th St. and Prospect Ave. Estimated cost, $50,000.

O., Cleveland—A. B. Lea, Swetland Bldg., is having plans prepared by Best & Hoefler, Archts. and Engrs., 6532 Euclid Ave., for the construction of a 1 story, 124 x 138 ft. garage, on Summer Ave. Estimated cost, $60,000.

O., Cleveland—Lincoln Motor Sales Co., c/o E. McGeorge, Archt., 1900 Euclid Ave., has awarded the contract for the construction of a 1 story, 75 x 160 ft. garage on East 37th St. and Prospect Ave. Estimated cost, $75,000.

O., Cleveland—The Minerva Engine Co., East 66th St. and Euclid Ave., has awarded the contract for the construction of a 1 story, 100 x 150 ft. foundry, on Dunham Rd. Estimated cost, $60,000. C. S. Goby, Pres.

O., Columbus—The Franklin Co. Commissioners plan to build a 1 story, 65 x 94 ft. machine shop on Rear Mound St. Estimated cost, $14,980. W. H. Fremaine, Chamber of Commerce Bldg., Archt.

O., Dover—The Dover Mfg. Co., c/o Poe Engineering Co., Archts. and Engr., Rockfeller Bldg., Cleveland, plans to build a 3 story, 80 x 200 ft. factory for the manufacture of electric and sadirons.

O., Lorain—The National Stove Co. has awarded the contract for the construction of a 1 story, 60 x 180 ft. addition to its factory. Estimated cost, $60,000.

O., Shelby—The Shelby Metal Product Co. has awarded the contract for the construction of a 1 story, 90 x 150 ft. factory. Estimated cost, $50,000.

O., Springfield—The Thompson Grinder Co., Main and Murray Sts., has awarded the contract for the construction of a factory on Main and Zwischler Sts.

Wis., Kohler—The Kohler Co., Press Bldg., Milwaukee, will build a 1 story, 100 x 290 ft. foundry.

Wis., Sheboygan—The Cigar Box Lumber and Mfg. Co. is having plans prepared by Juul & Smith, Archts. and Engrs., Imig Bldg., for the construction of a 1 story, 75 x 120 ft. machine saw, filing and power house, on 15th St. Estimated cost, $50,000. J. C. Will, Pres.

WEST OF THE MISSISSIPPI

Ia., Cedar Rapids—The Nash Motor Car Co., Kenosha, Wis., has awarded the contract for the construction of a 4 story, 80 x 140 ft. garage and office building. Estimated cost, $350,000.

Minn., Minneapolis—The Russell Grader Mfg. Co., University Ave. S. E., had plans prepared for the construction of a 1 story 424 x 600 ft. factory on Kennedy St., near Stinson Blvd. Estimated cost, $250,000.

Minn., St. Paul—The Snelling Garage Co. is having plans prepared by S. Jacobson and W. F. Stevens, Archts., 403 Endicott Bldg., for the construction of a 2 story, 50 x 125 ft. garage on Marshall and Snelling Sts. Estimated cost, $52,000.

Neb., Grand Island—Teeter & Hamair are having plans prepared by G. W. Graves, Archt., 43 John R St., Detroit, for the construction of a 4 story, 66 x 132 ft. garage and service station on Main St. Estimated cost, $80,000.

Tex., Houston—The Reed Roller Bit Co., 3602 Harrisburg Blvd., is preparing plans for the construction of a 1 story, 78 x 78 ft. factory. Estimated cost, $20,000.

Tex., Ranger—The Wright Brothers Boiler and Machine Co. plans to build a machine shop and boiler works. I. Rudman, C. A. Wright and S. E. Wright are the incorporators.

WESTERN STATES

Cal., San Bernardino—The W. J. Hanford Iron Works is having plans prepared by H. E. Jones, Archt., Katz Bldg., for the construction of a 1 story, 70 x 75 ft. factory. Estimated cost, $75,000.

CANADA

Que., Montreal—The Canadian Pacific R. R., Windsor St., has awarded the contract for the construction of 9 railway shops. Estimated cost, $500,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Middletown—The Goodyear Rubber Co., 114 Church St., will soon award the contract for the construction of a 3 story, 30 x 50 ft. and 50 x 220 ft. factory on Church St., here, for the manufacture of boots and shoes. Estimated cost, $90,000. Ford, Buck & Sheldon, Inc., 60 Prospect St., Hartford, Engrs.

Conn., Putnam—The Manhasset Mfg. Co., 83 Canal St., has awarded the contract for the construction of a 3 story addition to its plant for the manufacture of automobile tire fabrics. Cost to exceed $50,000.

Conn., Springdale — The British-Amer. Mfg. Co. has awarded the contract for the construction of a 2 story, 50 x 101 ft. addition to its plant, for the manufacture of waterproof fabrics. Estimated cost, $30,000.

Conn., Windsor Locks—J. R. Montgomery & Co. has awarded the contract for the construction of a 6 story, 62 x 65 ft. addition to its plant, for the manufacture of cotton goods. Noted March 11.

Mass., Chelsea—L. Cohen, Pearl St., is having plans prepared by S. S. Eisenberg, Archt., Exchange Bldg., for the construction of a 3 story, 40 x 60 ft. addition to his factory for the manufacture of woolen. Estimated cost, $25,000.

Mass., Dedham—The Dedham Finishing Co., Waverick St., has awarded the contract or the construction of a 2 story, 45 x 140 ft. factory. Estimated cost, $40,000. Noted Mar. 4.

Mass., Fall River—The Amer. Thread Co. has awarded the contract for the construction of a 5 story, 77 x 272 ft. mill. Estimated cost, $275,000.

Mass., Jamaica Plains (Boston P. O.)—E. Weiber, c/o S. J. Rantier, Archt., 1117 Columbus Ave., Roxbury, will soon award the contract for the construction of a 2 story, 40 x 60 ft. milk plant on Washington St. Estimated cost, $25,000.

Mass., Middleboro—The Nemasket Worsted Mills Co. has awarded the contract for the construction of additions to its plant, to include a 1 story, 70 x 140 ft. mill, a 1 story, 36 x 50 ft. weave shed, and a 1 story, 25 x 50 ft. office building. Estimated cost, $50,000. Noted March 4.

Mass., Salem—J. Friend, Endicott St., is having plans prepared for the construction of a factory on Derby and Congress Sts., for the manufacture and storage of boxes.

Mass., Springfield—The Victor Sporting Goods Co., 88 Birnie Ave., will soon award the contract for the construction of a 3 story factory. McClintock & Craig, 33 Lyman St., Archts.

Mass., Swampscott—Hillard & McMerrill Co. has awarded the contract for the construction of an 8 story, 60 x 1,350 ft. factory for the cutting of shoe soles. Estimated cost, $1,000,000.

Mass., Taunton — The Nobska Mills, Chandler Ave., has awarded the contract for the construction of a 60 x 125 ft. addition to its textile plant. Estimated cost, $30,000.

Mass., West Springfield (Springfield P. O.)—The New England Box Co., Greenfield, plans to build a factory on Cold Springs Rd., here.

N. H., Keene—The Carey Chair Mfg. Co. plans to rebuild its factory which was recently destroyed by fire.

N. H., Peterboro—The Joseph Noone's Sons Co. is having plans prepared for the construction of a 1 and 2 story addition to its plant, for the manufacture of woolen. Estimated cost, $75,000.

R. I., Cranston—The Imperial Printing & Finishing Co. has awarded the contract for the construction of a 1 story, 45 x 90 ft. addition to its plant. Estimated cost, $20,000.

R. I., Pawtucket—The J. and P. Coates Co., 366 Pine St., has awarded the contract for the construction of a 1 story, 40 x 76 ft. addition to its dyehouse.

R. I., Woonsocket—The Rosemont Dyeing Co., 292 East School St., will soon award the contract for the construction of a 2 story, 60 x 200 ft. addition to its plant. Estimated cost, $100,000. W. F. Fontaine, Federal Bldg., Archt.

MIDDLE ATLANTIC STATES

Del., Newark—The Continental Fibre Co. has awarded the contract for the construction of a 2 story, 75 x 140 ft. factory

Md., Baltimore—McCormick & Co., Light and Barre Sts., is building a warehouse and factory for the manufacture and storage of teas and spices. Estimated cost, $1,500,000.

Md., Baltimore—The Rennous Kleinle Co., 3221-29 Frederick Ave., manufacturer of brushes, has awarded the contract for the construction of a 1 story addition to its plant. Estimated cost, $10,000.

Md., Fairfield (Baltimore P. O.)—The Globe Shipbuilding & Dry Dock Co., Fidelity Bldg., Baltimore, will construct a 2 story, 60 x 150 ft. mold loft and a 1 story, 60 x 150 ft. joiners building, on the waterfront here. Estimated cost, $18,000.

Md., Towson—The Baltimore City Printing and Binding Co., 352 Equitable Bldg., will build a 2 story, 70 x 120 ft. plant. Estimated cost, $35,000.

N. J., New Brunswick—The Trenton Porcelain Co., 803 East State St., has awarded the contract for the construction of a 1 story, 30 x 150 ft. plant. Estimated cost, $20,000.

N. J., Trenton—The Kelso Mfg. Co., 58 Market St., manufacturer of asbestos fabrics, plans to build an addition to its factory.

N. Y., Buffalo—The Globe Belting Co. will build a plant at 1396 Clinton St. Estimated cost, $15,000.

N. Y., Buffalo—The Interlocking Reinforcing Concrete Corp., East Ferry St., along tracks of Erie R.R., has awarded the contract for the construction of a 1 story, 125 x 600 ft. factory. Estimated cost, $25,000.

N. Y., Evans Mills—The F. X. Baumert Co., Antwerp, plans to build a 2 story, addition to its milk plant, here. Estimated cost, $30,000

N. Y., Massena—The Massena Farmers Co-operative Corp. has awarded the contract for repairing and building an addition to its dairy. Estimated cost, $15,000.

N. Y., New York (Borough of Queens)—The Globe Thread Co., c/o Shampan & Shampan, Archts., 50 Court St., Brooklyn, has awarded the contract for the construction of a 3 story, 60 x 150 ft. factory, on Pierce and 7th Aves., here. Estimated cost, $42,000.

N. Y., Salamanca—The Salamanca Panel Co., 50 Elm St., has awarded the contract for the construction of a 1 story, 130 x 150 ft. factory. Estimated cost, $60,000.

N. Y., Union—The Union Milling Co. plans to repair its plant which was recently damaged by fire, and will also construct addition to same. Estimated cost, $80,000.

Pa., Altoona—The Hoffman Ice Cream Co., 1211 9th St., has awarded the contract for the construction of a 3 story, 48 x 75 ft. and a 2 story, 53 x 78 ft. plant at 901-3 Greene Ave and 900-2 11th Ave. Estimated cost, $77,100.

Pa., Bellefonte—The J. H. and C. K. Eagle Co., Inc., Franklin and Independence Sts., Shamokin, plans to build a 2 story, 100 x 120 ft. silk mill, here. Estimated cost, $125,000.

Pa., Philadelphia—The Franklin Worsted Co., York and Marcher Sts., will build a 2 story, 60 x 150 ft. mill on Venango and G Sts.

Pa., Philadelphia—E. Hubschman, Orianna and Willow Sts., manufacturer of leather goods, will soon award the contract for the construction of a 1 story, 60 x 90 ft. addition to his factory. Ballinger & Perrot, 329 South Broad St., Archts.

Pa., Philadelphia—The International Tire Co., Broad and Cumberland Sts., has awarded the contract for the construction of a 2 story, 70 x 80 ft. factory, on 29th and Dauphin Sts.

SOUTHERN STATES

N. C., Franklinton—Franklinton Hosiery Mill plans to build a 100 x 120 ft. mill. J. E. Sirrine, Greenville, S. C., Engr.

N. C., Spindale—The Stonecutter Mills plan to build a 2 story, 106 x 292 ft. cotton mill and a 1 story, 157 x 420 ft. weave shed. J. E. Sirrine, Greenville, S. C., Engr.

S. C., Greenville—The C. M. Goodyear Co. plans to build a 3 story, 100 x 250 ft. waste plant. J. E. Sirrine, Greenville, Engr.

S. C., Warrenville—The Warren Mfg. Co. plans to build a 150 x 250 ft. weave shed. J. E. Sirrine, Greenville, Engr.

Tenn., Knoxville—The Holston Box and Lumber Co. will build a 150 x 225 ft. factory to replace one destroyed by fire.

MIDDLE WEST

Ill., Chicago—The Kroeck Paper Box Co., 220 Institute Place, has awarded the contract for the contruction of a 3 story, 130 x 140 ft. factory at 1701 West Superior St. Estimated cost, $200,000. Noted Feb. 26.

Ind., Evansville—The Liquid Carbonic Co., Heidelback Ave. and Indiana St., will soon award the contract for the construction of a 2 story, 80 x 150 ft. factory. Estimated cost, $50,000. C. Shopbell, 707 Furniture Bldg., Archt. Noted March 11.

Mich., Flint—The Bd. of Educ. is having revised plans prepared by Malcolmson, Higginbotham & Palmer, Archts., 405 Moffat Bldg., Detroit, for the construction of a 2 story, 208 x 287 ft., high school, to include manual training department. Estimated cost, $1,250,000.

O., Cleveland—G. F. Haynam, mgr. of the Variety Cabinet Co., 1421 East 40th St., has awarded the contract for the construction of a 2 story, 50 x 100 ft., factory on East 66th St. near Euclid Ave. Estimated cost, $50,000.

O., Cleveland—The A. P. Schauer Co., 3303 Payne Ave., manufacturer of patterns, has awarded the contract for the construction of a 2 story, 20 x 60 ft. factory. Estimated cost, $100,000.

O., Toledo—The Modern Glass Co., 617-19 Nicholas Bldg., has increased its capital stock from $1,000,000 to $1,500,000, and plans to build additions and extensions to plant.

Wis., Jackson—The Jackson Canning Co. will soon award the contract for the construction of a plant to include several 1 and 2 story buildings. Estimated cost, $50,000. H. V. Miller, 646 24th St., Milwaukee, Archt.

Wis., Milwaukee—The Federal Cone and Candy Co., 100 George St., has awarded the contract for the construction of a 3 story, 50 x 60 ft. factory.

Wis., Milwaukee—The Trapp Brothers Dairy Co., 86 Burleigh St., has awarded the contract for the construction of a 2 story, 70 x 110 ft. dairy. Estimated cost, $75,000.

Wis., Oconomowoc—The Oconomowoc Canning and Products Co. will soon award the contract for the construction of a cannery to include several 1 and 2 story buildings. Estimated cost, $60,000. H. V. Miller, 646 24th St., Milwaukee, Archt.

WEST OF THE MISSISSIPPI

Ia., Sioux City—The Chesterman Co., 405 Pearl St., has awarded the contract for the construction of a 3 story, factory for the manufacture of pop. Estimated cost, $100,000.

Kan., Wichita—The Johnson Larimer Dry Goods Co. will soon award the contract for the construction of a 5 story 75 x 140 ft. factory and warehouse. Estimated cost, $150,000. L. Schmidt & Co., 121 North Market St., Archts. Noted April 1.

Minn., Minneapolis—The W. T. Rawleigh Co., Freeport, Ill., has awarded the contract for the construction of a 2 story, 50 x 160 ft. factory on 10th Ave. N., and 3rd St. here, for the manufacture of medicine. Estimated cost, $60,000.

Mo., Webster Groves—Bd. Educ. plans to build a 2 story addition to the Bristol School, to include 24 x 55 ft. and 21½ x 35 ft. manual training rooms. Estimated cost, $160,000. W. B. Ittner, Bd. Educ. Bldg., St. Louis, Archt.

Tex., Dallas—The Fleischman Co., 711 North Ervay St., manufacturer of yeast, is preparing plans for the 1st unit of its plant, to cost $1,000,000, ultimate cost, $1,500,000. Address, G. W. Neary, 4630 Munger Ave.

Tex., Houston—Gordon Sewall & Co., Inc., Commerce Ave. and San Jacinto St., is preparing plans for the construction of a 1 story, 60 x 112 ft. canning factory. Estimated cost, $20,000.

WESTERN STATES

Cal., Chino—The Chino Walnut Growers Association has awarded the contract for a 1 story packing house. Estimated cost, $25,000.

Cal., Oakland—The Palmolive Co., 42 4th St., Milwaukee, is having plans prepared by Lockwood, Green & Co., Engrs., 38 South Dearborn St., Chicago, for the construction of an oil mill. Estimated cost, $500,000.

Cal., Pasadena—S. Storrow has awarded the contract for the construction of a 2 story, 85 x 140 ft. factory on Raymond Ave. near North Dayton St., for the manufacture of bricks. Estimated cost, $38,615.

Cal., Puente—La Puente Walnut Growers Association has awarded the contract for the construction of a 1 story, 175 x 200 ft. packing house. Estimated cost, $125,000.

Wash., Seattle—The Hardeman Hat Co., Republican St. and 7th St. N., has awarded the contract for the construction of a 4 story, 32 x 120 ft. factory at 123 Westlake Ave. N. Estimated cost, $55,000.

Wash., Spokane—J. G. F. Hieber, 2011 1st Ave., is having plans prepared by H. E. Smith, Archt., 1211 Old Natl. Bank Bldg., for the construction of a 3 story, 73 x 110 ft. plant, for the manufacture of fruit juice. Estimated cost, $100,000.

CANADA

Ont., Ottawa—The Standard Bread Co., Hillson Ave., plans to build a bakery on Oliver St. Estimated cost, $150,000. S. C. Morrison, Mgr.

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